INFORMATION

SINGLE-SIX

"1-26" and "1-33"

Packard

MOTOR CARS

MARCH, 1922

Price Fifty Cents

Issued by
THE TECHNICAL SERVICE DEPARTMENT
PACKARD MOTOR CAR COMPANY
DETROIT, MICHIGAN

VT 224-10M-3-22

Packard Distributers' Service Policy

New Motor Carriages

Packard service has been organized for the purpose of assisting Packard owners to keep their motor carriages in good repair and adjustment.

Packard service includes the following:

1. We will make all necessary adjustments for one month after delivery of the motor carriage, provided it is brought to our Service Department for that purpose and has not been tampered with or injured through accident or neglect. After that time all work will be done at our regular charge for such work, except as noted in Clause 2.

2. We will install at our service station without expense to an owner either for part, labor or transportation, any part that may be replaced as defective by the Packard Motor Car Company or ourselves under the warranty printed below, for a period of ninety days after delivery of the motor carriage to the purchaser.

3. All gratis work under the Packard warranty is to be done at our service station, and in the event an owner requests warranty work to be done at a distance from our service station the expenses of the workman for transportation, board and lodging, if any, will be charged to the customer.

4. If, at the time warranty work is being done, we are called upon to do other work which does not come under the warranty, the labor and material required for such work will be charged for at our regular rates.

5. It is understood that inspections and instructions concerning the operation and care of Packard vehicles, though made by our employees, are in fact made on behalf of the owner, and that the inspector or instructor is acting for him. The owner, therefore, waives all claims arising out of any fault or omission in connection therewith.

6. It is our intention to give every purchaser of Packard motor carriages fair and businesslike treatment. Should any patron not receive it, we ask in good faith to be so advised.

Warranty of Packard Motor Car Company of Detroit

For a period of ninety days from the date of delivery to the purchaser, we fully warrant new Packard motor carriages and trucks to be free from defects in material and workmanship: thus, we will replace free of charge any part claimed within such ninety days to be defective and found so by us upon examination, provided such part is returned to us for credit or replacement. Such free replacement does not include transportation charges to and from the Packard factory, nor the cost of installing the new part. Tires, rims, batteries, speed instruments and other accessories, which are subject to warranties of their respective manufacturers, are excepted from this warranty.

The Packard Motor Car Company reserves the right to make changes or improvements at any time, without thereby incurring any obligations either to install the same on motor cars previously sold or to install the old part, which has been changed, improved or omitted, in new cars subsequently sold.

OPERATION AND CARE

of

SINGLE-SIX

"1-26" and "1-33"

Packard

Motor Cars

Instructions for Ordering Parts

It has been found impracticable to provide owners with parts price lists which will be complete and up-to-date at all times. Owners desiring parts information not contained in this book, are referred to Packard distributers who will be provided with a comprehensive and up-to-date parts and price list for all models.

Parts in most frequent demand are shown in this book. The numbers on the illustrations are for identification of part only. Owners should order parts by name, and not by number.

Packard Parts

Close interchangeability and continued efficiency are best assured by making replacements only with parts made by the Packard Motor Car Company. Owners are advised to consult Packard distributers about all repairs, adjustments and replacements.

Ordering Parts

It is advisable to order all parts from authorized Packard distributers.

When ordering parts from Packard distributers or the factory, specify:

Shipping directions.
Name of part.
Model symbol such as "1-26" or "1-33."
Style of car, chassis or body (Touring Car, Sedan, etc.).
Vehicle number (on manufacturers' patent plate).
Motor number of car (stamped on right front upper half of crank case).
Color, if part is painted.

Terms

All prices are net, F. O. B. Factory, Detroit, Michigan.

Our responsibility ceases when goods are delivered in good condition to the transportation companies.

All quotations on parts or supplies are subject to change without notice.

Accounts are opened only with Packard distributers.

Orders from individuals which are not accompanied by cash will be sent C. O. D.

Technical Service Department

The Technical Service Department of the Packard Motor Car Company will furnish, at any time, specially desired information concerning parts or on the operation and maintenance of Packard vehicles.

General Operation

To Prepare the Car for Service

Packard cars are shipped from the factory properly adjusted and lubricated. The gasoline tank and cooling system are emptied before shipment.

New cars delivered to owners by Packard distributers will be in perfect running condition. In putting a car into service for the first time or after it has been in storage, the following simple instructions should be followed:

Fill the radiator with clean water.

Fill the gasoline tank.

Be sure that cylinder oil in crank case is up to petcock level.

See that all parts requiring lubrication are supplied with the proper lubricant. See "Schedule of Lubrication" on page 9.

Wash the Car

The car should be washed frequently, especially when new, until the varnish has had a chance to become thoroughly hardened.

Preliminary to Starting the Motor

The following directions are applicable whenever the car is run, but if it is being put into service for the first time, or has been in storage, follow carefully the instructions of "Care of Car in Storage" on page 17 under the heading of "Care of Motor."

Put the change speed lever in neutral position.

Complete instructions for the operation of this lever on page 6.

Set the hand brake.

Set the spark lever one inch back of full advance.

Open the throttle slightly.

Operation of the throttle lever on the steering wheel and its relation to the accelerator pedal will be found on page 33.

Adjust the carburetor control, which is above the ammeter on the instrument board. In cold weather, or with a cold motor, pull the control all the way out to "Choke." In warm weather, or with the motor warm, this will not be necessary, in fact it may prevent starting; see page 32.

To Start the Motor

Turn the ignition switch on.

Crank the motor, using electric starter by depressing starter button, see page 42, releasing it immediately after the motor starts.

After the Motor Starts

Be sure to push the carburetor control toward the dash as far as possible, maintaining smooth motor operation.

It will be necessary to give the motor more gas while cold than after it has become warm by running. This should be accomplished by opening the throttle slightly.

After the Motor is Warm

Close the throttle until the motor runs slowly. The carburetor control should have been pushed clear to the dash by this time.

To Start the Car

Take position behind steering wheel.

Be sure the spark lever is advanced within one inch of full advance.

Release the hand brake.

Push forward the left pedal to release clutch.

The clutch must always be disengaged while shifting gears.

Move the change speed lever laterally to the left, then straight back into first speed position.

Increase the speed of the motor slightly.

This may be done by advancing the hand throttle lever several notches or by pressing on the accelerator pedal. An experienced operator will perhaps obtain the best results by using the accelerator pedal for increasing speed and releasing it during all shifting operations.

Gradually engage the clutch.

The car will move forward. Allow it to gain speed.

Again disengage the clutch.

Move the change speed lever forward through neutral position then to the right and straight forward into second speed position.

Cultivate the habit of making all shifts without looking at the shifter lever. Keep your eyes on the road.

Engage clutch and open throttle gradually to increase the motor speed.

Allow the car to gain speed.

Again disengage the clutch.

Move change speed lever straight back into third speed position, taking care not to move it to the left when passing the neutral position.

Engage the clutch.

Attain the desired speed by pressing with the right foot on the accelerator pedal or by advancing the hand throttle lever.

CAUTION: The car will gain speed very rapidly and care should be taken to keep the speed within the safe limit determined by road conditions and traffic. A speed of thirty miles an hour is equivalent to approximately forty-five feet of car travel a second and ample time should always be allowed for emergency stopping.

To Change Back into Lower Speeds

If, on account of a very steep grade or heavy going, the speed is reduced until the motor labors, shift the gears at once into the next lower speed as follows:

Disengage the clutch. If the car is moving at a low rate of speed, instantly move the change speed lever into the next lower speed and engage the clutch. At higher car speeds, this shift is facilitated by partially or wholly engaging the clutch and simultaneously speeding up the motor, in the interval between the disengagement of the higher transmission speed and the engagement of the lower one. This of course necessitates a slight pause of the change speed lever in the neutral position.

To Stop the Car

Reduce the motor speed. Disengage the clutch and apply the foot brakes. When the car has stopped, with the clutch still disengaged, place the change speed lever in neutral position. Set the hand brakes and release foot pressure from the clutch pedal.

To Reverse the Car

When the car has stopped, release the hand brakes, disengage the clutch and move the change speed lever from neutral position laterally to the left; then forward into reverse and engage the clutch.

Never attempt this operation while the car is moving forward.

To Stop the Motor

Turn ignition switch on instrument board off. This is important because if the motor is stopped with the switch on, the battery is apt to discharge itself through the ignition apparatus.

Hints on Good Driving

Low operating cost depends as much upon good driving as careful attention to the upkeep of the car. The driver can be judged according to whether or not he observes the following rules:

(1). Respect the rights of others, particularly pedestrians.

(2). Drive in such a manner as to require the use of the brakes as seldom as possible. When approaching an obstacle which necessitates stopping the car, ease up on the accelerator pedal so that the car will almost come to a standstill at the desired spot. Throw out the clutch and apply the brakes gradually a short distance from the final stop. Maximum mileage (excepting as obtained by "stunt driving") will then be obtained out of tires and gasoline, and the brakes will require adjusting less frequently.

(3). Drive with the carburetor control all the way in against the dash at all times, except when starting with the motor cold. Even with a cold motor it will not be necessary to run with a rich mixture for more than a few

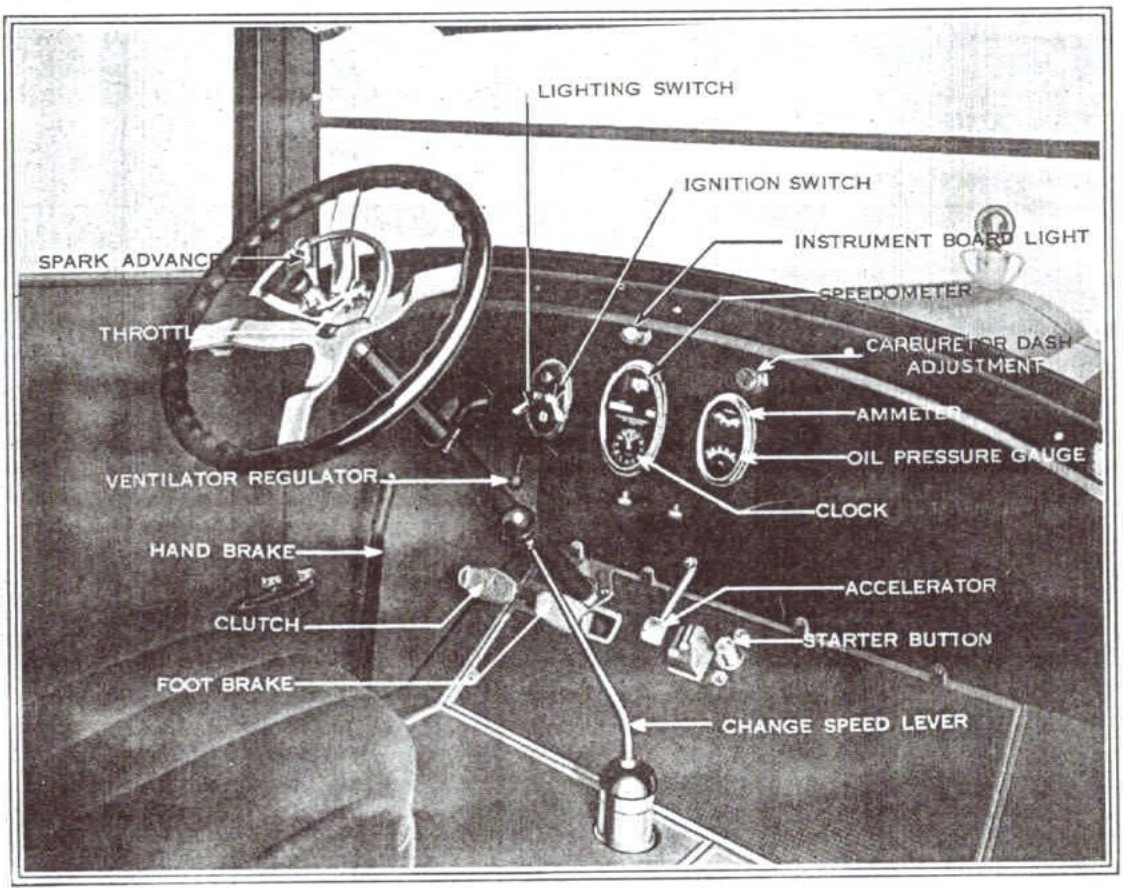


Plate No. 1—Instrument Board and Control

hundred feet. Observing this rule is very essential if you wish to obtain high gasoline mileage as well as to reduce dilution of the crank-case oil and carbonization of the motor.

(4). Drive with the spark within one inch of fully advanced at all times, except when climbing steep grades at low speed, at which times it should be retarded as required, see page 35. When driving at maximum speed the spark should be fully advanced.

General Lubrication

Keep Mechanism Clean

Keep all working surfaces, oilers and connections, free from dirt and the motor and all other parts as clean as possible.

An oily motor very rapidly collects dust and dirt, which eventually work into the mechanism and cause premature wear.

Lubricants

Do not use cheap or little known lubricants. High grade lubricants are the most economical in the long run. It is always safest to buy lubricant from a concern with an established reputation. Such concerns handle a large volume of business, and their experience and responsibility are the best insurance.

Cylinder Oil

A high grade medium Gas Engine Cylinder Oil should be used. In cold weather trouble may be encountered in oils with too high a cold test. In Detroit the Packard Motor Car Company uses an oil with a cold test of under 25 degrees Fahrenheit.

Cup Grease

At all points in the lubrication schedule where reference is made to "Lubricator Connector," use the special grease gun supplied with the tool equipment. This gun has a bayonet socket which fits over the connector. Two or three turns of the handle are sufficient at each connector.

Use a high grade medium body yellow cup grease.

Rear Axle Gears and Differential Lubricant

Use a good rear axle gear fluid oil.

In cold weather the lubricant should be thinned with cylinder oil to approximately its Summer consistency.

Transmission Gear Lubricant

Use a good transmission gear fluid oil.

In cold weather cylinder oil should be used to thin the lubricant as in the case of the rear axle.

Universal Joint Lubricant

Use a good universal joint grease.

Schedule of Lubrication

Oiling

Before adding any oil to the motor, read instructions on page 23, which give a complete description of the motor oiling system, its operation, care and adjustment.

EVERY 500 MILES

Ref. No.	Point to Lubricate	Name
1	12 Lubr. connectors	Spring bolts, front and rear, one in front and two in rear of each spring.
2	4 Lubr. connectors	Steering knuckle pins.
3	Crank Case	Add oil as required.

EVERY 1000 MILES

4	2 Lubr. connectors	Steering lever ball joints
5	2 Lubr. connectors	Steering cross tube
6	2 Oilers	Starter Motor
7	2 Oilers	Generator
8	2 Oilers	Distributor
9	2 Felt washers	Horn—Oil sparingly
10	1 Lubr. connector	Motor water pump shaft bearing
11	2 Lubr. connectors	Rear axle brake shaft
12	1 Lubr. connector	Rear axle torque arm support hinge bolt
13	2 Lubr. connectors	Rear axle torque arm rear end pins
14	1 Oiler	Steering post upper bearing
15	Examine battery	Plates should be submerged ¼ inch. Add distilled water to obtain this result. See page 38.
16	Crank Case	Drain and refill. See page 26.

EVERY 5000 MILES

17	2 Hubs	Front wheel hubs and bearings, pack with grease.
18	1 Brush and 1 Cam	Distributor—Remove head, wipe clean inside, apply gun oil and again wipe with clean rag, at the same time wipe and apply a minute quantity of vaseline to cam.
19	Transmission	Transmission case—fill with oil to level of plug on right side.
20	Rear axle	Rear axle case—fill with oil to level of plug at rear of axle.
21	Steering	Steering gear case—pack with mixture of half grease and half gear fluid oil to plug opening.
22	2 Lub. connectors	Two universal joints.

EVERY 10,000 MILES

Transmission	Drain, flush with kerosene and refill to plug level (in side of case).
Rear axle	Drain, flush with kerosene and refill to plug level (in rear of axle) **Note:** Remove rear cover plate for draining and flushing

Note

Whenever brakes are relined or when rear wheels are removed from axle shafts for other reasons, rear wheel bearings should be cleaned and repacked.

Whenever clutch is relined or removed for other purposes, the clutch front bearing should be cleaned and repacked.

Periodic Inspection and Care

General Care

Periodic and systematic inspections and adjustments of wearing parts of the car, in addition to regular everyday attention, such as washing and cleaning, keeping tanks and reservoirs filled, tires properly inflated etc., are necessary in order to obtain the highest degree of efficiency which the car is capable of giving.

Adjustments should not be made until necessary, although it is very important that thorough inspections be made at regular intervals to prevent excessive wear or loss of power due to causes which may not be readily detected in ordinary running. The principal points requiring attention are listed below. Any symptom which may arise and which would generally be indicated by an unusual noise, should be corrected immediately, before it has had a chance to develop into any serious trouble.

A schedule for the lubrication of all parts of the chassis is perhaps the most important thing in connection with the care of the car, and will be found on page 9.

Every Day

Inspect gasoline supply.

Check level of water in radiator.

Be sure that oil pressure gauge on instrument board shows pressure the moment the motor is started.

See that tires are properly inflated and examine for imbedded glass, small cuts, etc. See instructions for proper care of tires on page 13.

Once a Month or Every 1000 Miles

Inspect and, if necessary, adjust brakes.
See directions on page 53.

Inspect tension of fan belt.
Instructions for adjustment on page 45.

Inspect the ignition breaker contact points.

Contact points if working properly, will have a silver gray appearance with a pebbled surface at point of contact.

New points may show only a small spot, usually near the edge, and when in this condition should not be disturbed. If the points are blackened they should be cleaned and adjusted as outlined on pages 9 and 34.

Full directions regarding the care of battery on page 38.

Examine cooling system for leaks, tightening pump gland nut, if necessary.

Clean gasoline system. See care of vacuum tank on page 29 and carburetor and fuelizer on page 29.

Examine body and motor to frame bolts, spring clips, etc. Keep tight.

Check alignment of front wheels. For further information see page 52.

Check adjustment of front end chain. See page 22.

Care of Body and Finish

Washing the Running Gear

Most of the mud, dirt and grease will be found on the chassis and the underparts of the fenders. This mud may be loosened with slow running clear water, but the oil and grease must be removed with a soap solution. A good solution is made by dissolving one pound of a non-alkali soap to a gallon of warm water. Do not use the body sponge to wash the fenders.

Washing the Car

Extreme care should be used in washing the car, especially during the first few months that it is in use.

Varnish requires some time to season thoroughly and while seasoning is easily affected.

CAUTION: Use only the best of commercial soft soap which is free from alkali or acids.

Mud, water, grease or oil should not be allowed to remain on a car longer than it is possible to avoid. This is particularly true of new cars on which the varnish may not be thoroughly seasoned.

Soak mud off with plenty of running water instead of rubbing it off. Do not use excessive water pressure.

Any rubbing that is absolutely necessary should be done lightly and in straight lines from top to bottom, rather than in circles.

Keep sponge perfectly clean while rubbing body. For drying the car after washing, use a clean, damp chamois skin.

The car should not be washed in the hot sun which will dry the panels before the chamois has been applied.

Heavily accumulated dust should be removed by washing rather than by dusting. For light dusting, a woolen duster is preferable to one made of feathers.

If an enclosed body is exposed to low temperatures shortly after having been washed, the water banked up at the lower edges ofthe windows may freeze and prevent their being lowered. This will not occur if the windows are lowered slightly for a short period to enable the water to drain away.

Hood and Fenders

Do not wash the hood of the car immediately after a run, while it is still warm. This sometimes causes the luster to disappear.

After washing the hood and fenders they should be dried and polished by rubbing lengthwise with a soft cloth or chamois skin.

Running board covers can best be cleaned with soap and water. Thoroughly rinse with running water after cleaning.

CAUTION: Care should be taken in raising and lowering the bonnet sides to prevent defacing the body beading adjacent the rear of the bonnet, the fenders and radiator shell.

Nickel Polish

Good silver polish is best for removing tarnish from nickel. Nickel trimmings may be prevented from tarnishing by rubbing the surface frequently with an oily rag. This will keep them bright without polishing.

Do not use brass polish on nickel, as the abrasive ingredients scratch the surface.

CAUTION: Enclosed body interior fittings, such as regulator handles, are lacquered over the silver plating, and should, consequently, never be polished with a metal polish.

Care of Tops

Never fold the top while it is damp. Dust on the outside of tops should be removed with a sponge and soapsuds. Use plenty of clean water to remove all traces of soap. The inside or cloth side should be dusted with a whisk broom or stiff brush. Remove stains with soap and water, using a brush instead of a sponge.

The cloth side should be washed and dried more carefully than the outside. Impure water or soap may change the color and make it necessary to go over the entire lining.

Carriage dressings and gasoline are generally injurious to either the inside or outside, as they will kill the luster and cause the material to harden.

Instructions for Lowering Touring Car Top

Unfasten gypsy curtains from the rear bow sockets and body fasteners, folding them in against the back curtain. This is absolutely necessary to prevent tearing the top when folded. Attach bow support brackets. The brackets should be located so that the bows will fall in them properly. Open both bow support clamps.

Loosen flap across top of windshield and remove the acorn nuts and lock washers from the top of the windshield stanchion. Lift top off of the windshield and replace acorn nuts and washers.

Break the top support for forward half of top, by raising the front bow with one hand and taking hold of the brace directly above the back of the front seat, pulling straight down until broken joint is within about four inches of the body moulding. In this position tip bows back until rear bow rests in the bow support bracket.

The lining padding should be pulled down neatly between the bows and pushed in toward the center, so that when the top is down the pads will be between the rear seat and the top and not between the bows.

Step to the rear of the car and pull the top material out from between the upper bows, letting it hang in a double fold. Then make a triangular fold at each corner and fold the material twice, laying it neatly in place on the lower bow. Engage the hook at the top of the bow support bracket and clamp, making sure that none of the top material is clamped between the bow sockets and bow support bracket.

A top envelope should be procured and attached if the car is to be driven with the top down for any considerable period.

In applying the top envelope, see that the loose folds of the top are snugly stowed in place. Slip on the top envelope, drawing tightly in place with the straps that will be found at the front end. Attach the two supporting straps to the two binding posts on the back of the body. This will support the rear curtain light and prevent damage to the back of the body. Bring the two straps found at each lower corner of the envelope up between the body and the bows and around the bow support clamp. This strap will pull the under side of the envelope together with the loose folds of the top material up a sufficient distance to prevent scratching or marring the painted surface of the body.

Instructions for Raising Touring Car Top

Remove top envelope, unfasten bow support clamps and disengage bow hook, which is located toward the front of the bows.

Remove the two acorn nuts and lock washers from the top of the windshield stanchion.

Raise the front bow high enough so that the lower hinged joint clears the body moulding by about four inches, then lift the whole bow assembly and push the bows into place. Bring the forward bow down into position over the windshield and replace the lock washers and nuts. Remove bow support brackets. Snap gypsy curtains into place.

Side Curtains

Side curtains should be wiped with a cloth before being stowed away.

Removing dust and grit from the side curtains will help to keep the celluloid lights from becoming scratched. Curtains should be folded with the identification labels which are sewed to them, on the upper side, and put away in order so the celluloid lights contact with curtain material rather than with other lights. The curtains are stowed in the large door pockets on the left side.

Lubrication of Body Parts

It is a good plan to occasionally put a drop or two of oil on the working parts of the windshield, also door locks and hinges, foot rest, robe rail, etc. Lubrication of these parts will keep them in a free working condition and will assist in eliminating squeaks.

Care of Tires

Tire Information

To keep down the upkeep expense and to make sure of uninterrupted service, one of the best things is to properly care for the tires.

There are certain common sense rules which apply to the three parts of a tire—carcass, tread, tube.

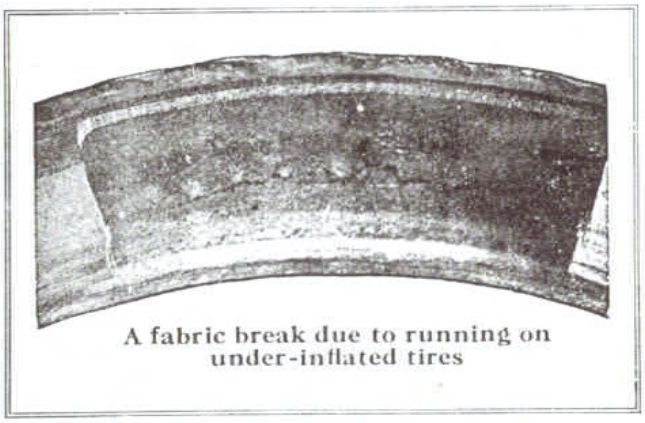
Care of the Carcass

The carcass or body gives strength to the tire as long as the cords or fabric remain unbroken.

Under-inflation

The most common cause of a broken carcass is under-inflation. Keep front tires inflated to 60 pounds pressure and rear tires to 65 pounds.

Keeping the tires always at these pressures results in the best compromise between easy riding and maximum mileage.



A fabric break due to running on under-inflated tires

When an under-inflated tire revolves, the excessive flexing of the carcass sets up heat which destroys adhesion of the fabric or cord layers. They separate, weaken and finally show a break around the inner tire as illustrated.

If the injury is discovered before more than the innermost plies are broken, a reliner may be cemented or vulcanized in and the tire placed in service again. If the injury is more serious it cannot be repaired and, therefore, it is better to prevent this trouble by close attention to air pressure.

Test the tire pressure with a reliable gauge once a week.

When touring this should be done every morning. Air pressure is affected comparatively little by heat and should not be diminished because of hot weather.

In case of tire trouble on the road do not run the tire flat even for a hundred feet, for the carcass will be mashed between the steel rim and the road and will be broken so that repairing is impossible.

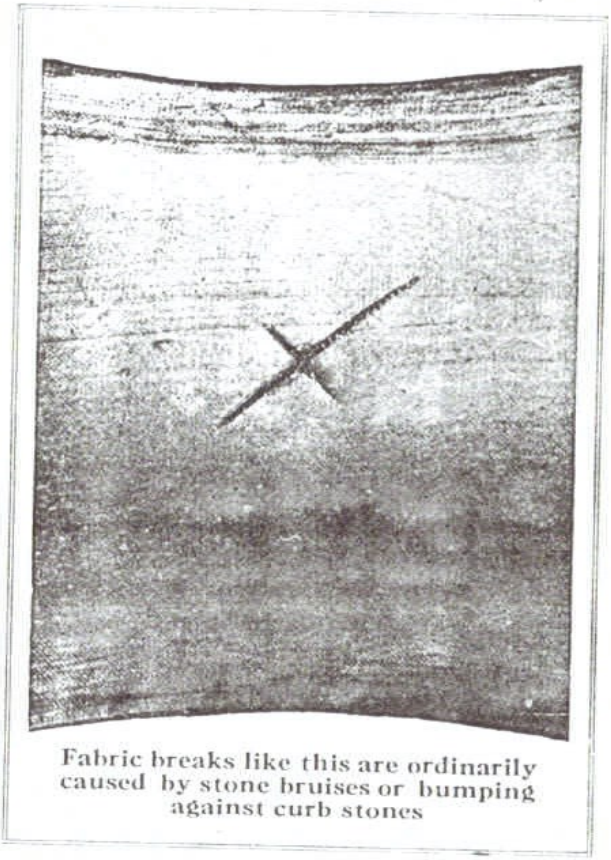
Fabric Breaks

Fabric breaks in the carcass, unlike those caused by under-inflation, do not extend around the circumference of the tire, but always cross it on a diagonal as shown in the illustration.

These injuries are often called "bruises" because they result from sudden shocks when tires strike stones, curbs or holes in the road while traveling fast.

To prevent fabric breaks keep the proper pressure and drive slowly over rough spots.

For making roadside repairs of fabric breaks use a cord patch or a rim cut patch applied with one coat of cement so that it can be later removed and a vulcanized repair made.



Fabric breaks like this are ordinarily caused by stone bruises or bumping against curb stones

Care of the Tread

The tough tread or rubber covering of the carcass gives the tire its wearing quality.

Though the tread rubber is tough it may occasionally be cut by such objects as a piece of tin, a sharp stone or a broken bottle.

Unless repaired while still new these small cuts are soon enlarged and dirt, sand and water work through them rotting the carcass and finally causing a blow out.

The illustration on page 15 shows how a small cut, if neglected, may completely ruin a tire in this manner. It is wise to inspect treads frequently and to close any new cuts with the aid of a tire putty outfit.

A good method is to clean out the cuts with gasoline. Apply some cement, and then fill in tightly with a little tire putty. Allowing this to harden overnight seals the cut. Big cuts and mud blisters should be vulcanized at once.

Misalignment and Wobbly Wheels

An unusual jolt or strain from bumping a curb, hitting a rise or hole in the road, or from scraping along gutters, may cause misalignment or wobbling of wheels or both.

Then rapid tread wear results because the wheel no longer runs true with the one opposite but, instead, travels over the road with a diagonal grinding motion.

To check proper alignment of front wheels, set them straight ahead and measure the distance between points on the felloes in front of axle and at similar

points at rear of axle, measurements to be made at same height as the axle. Front measurement should be $\frac{1}{8}$ to $\frac{3}{16}$-inch less than the rear.

Tread Wear Caused by Brakes and Clutch

To prevent scraping off tread rubber always apply the brakes gradually. When brakes are thrown on suddenly the wheels lock and the tires are dragged over the pavement for several feet.

The brake bands on both wheels should be kept equally adjusted. Otherwise all the work of stopping the car is done by the wheel with the tighter brake, and this tire receives abnormal wear.

Letting the clutch in too suddenly is another cause of worn treads by causing the tires to slip before getting a grip on the road surface.

Scraped Side Walls

When the rubber on the side walls of a tire is scraped off by ruts or curbs the cord or fabric underneath is exposed to the rotting action of dirt and moisture.

Repair small side wall cuts while still new with cement and tire putty and have large ones vulcanized at once.

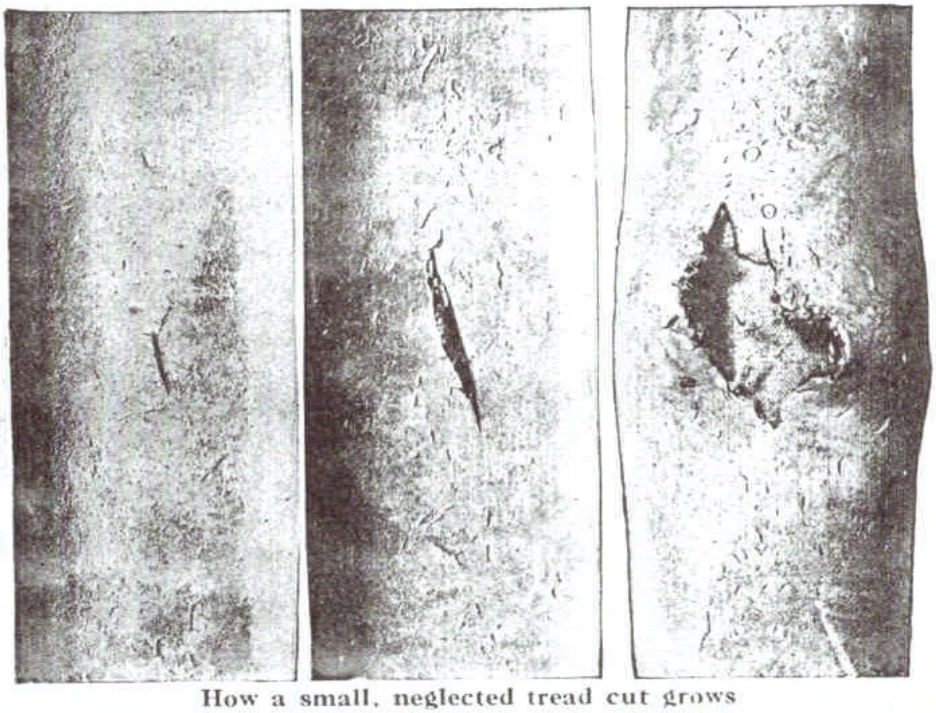
Cuts Caused by Chains

Always apply chains loosely because if applied tightly the cross chains strike the tire at the same spots continually and soon cut into the tread.

Never put chains on one rear wheel only because the opposite wheel will spin and wear the tread of the tire and the differential is also liable to damage.

Do not reverse chains by placing the worn side aginst the tire as the edges of the links sharpened by use cut into the tread.

If chains are necessary in an emergency remove them as soon as the emergency is passed.



How a small, neglected tread cut grows

Effect of Heat, Light and Oil

Always protect tires from excessive heat and light as these harden the tread and make it wear more rapidly. Spare casings should be carried in tire covers.

Don't let the tires stand in oil on the garage floor, as oil and grease cause the tread to rot, stretch, and pull loose. When tires come in contact with oil or grease, clean them with gasoline.

How Car Tracks Wear the Tread

When driven in car tracks only part of the tire's width runs on the rail and supports the load. Therefore, where the edge of the tire comes in contact with the track a groove is worn around the tread and the carcass underneath is strained.

Although a tire injured in this manner can usually be repaired by retreading and inserting a reliner it is better economy to prevent trouble by keeping away from car tracks.

Care of the Tube

A tube has one work to do. It must hold air. Use good tubes and keep them air tight by common sense methods of care.

Tube injuries may be divided into three classes—those occurring before the tube is placed in the casing, those occurring when the tube is being applied and those occurring after the tube goes into use.

A spare tube may be made entirely unfit for service by jostling around in its cardboard container or loose in the tool box as the car bounds over the road. Soon the folded edges are chafed through, the tube is cut by sharp objects in the tool box and the rubber is sometimes rotted by contact with oil and grease.

Spare tubes should be folded, dusted with mica or French talc then wrapped in a cloth or placed in a tube bag to prevent chafing.

Never hang spare tubes in the garage exposed to strong light or heat as this deteriorates the rubber.

Applying the Tube to Prevent Injury

See that there is no dirt or rust on the rim. Examine the inside of the casing for fabric breaks, nails, dirt or other foreign matter which may injure the tube.

Dust the inner surface of the casing with mica or French talc to keep down friction between the tube and casing. Do not use too much, however, or it will cake in one spot and chafe into the tube.

Inflate the tube slightly and place it perfectly straight in the casing, making sure that the flap, if used, is not old, rusty or twisted.

Mount the tire, guarding the tube from slipping under the bead so that it will not be pinched between bead and rim. When using tire irons be sure they are smooth and handled carefully to prevent gouging into the tube.

The quickest way to ruin a tube is to run on a flat tire, as the tube is ground and torn by the rim.

Valve leaks can be largely prevented by being careful to always screw on the valve cap tight after inflating a tire or testing pressure. The cap keeps out dirt and in addition holds the air in, even if the plunger leaks.

Changing Tire Rims

Remove valve cap and clamp nuts. With valve at the top, pull bottom of tire toward you. When clear, tire can be removed by lifting straight up.

In replacing, turn valve hole to the top, insert valve stem in hole and push bottom of tire into place.

Replace the clamps and tighten slightly. Seat firmly by tightening clamps that are directly opposite each other. Screw in valve cup. If rim does not run true, loosen nuts on the part that is in and tighten clamps at point that is out, proceeding this way until rim runs true.

CAUTION: Make sure, in applying a rim that the driving lug on the rims properly engages with the aperature provided for it in the felloe of the wheel. Failure to obtain this engagement is apt to permit the rim to creep on the wheel to the extent of shearing off the valve stem.

Care of Car in Storage

Storage Space

Cars or bodies taken out of service for any length of time should be carefully prepared for storage and kept in a dry garage, preferably with some heat and with a subdued even light from all sides.

Avoid extreme heat or sudden changes in temperature and the immediate proximity of steam pipes.

Protection of Finish

Wash the car carefully before storing and be sure that all oil and grease spots are thoroughly removed from the painted and enameled parts.

Varnish on a black ground always has a slightly greenish tint. Continued absence of light will increase this greenish cast. Washing a stored body once or twice a month will reduce the tendency of the varnish to change color. Varnish that has turned green from being in a dark place will resume its natural shade after lengthy exposure to the light.

Draining the Water System

Drain the water system thoroughly before leaving car in storage.

Care of Motor

When laying up the car, drain the crank case, flush with kerosene, refill with fresh oil and run the motor for a few minutes.

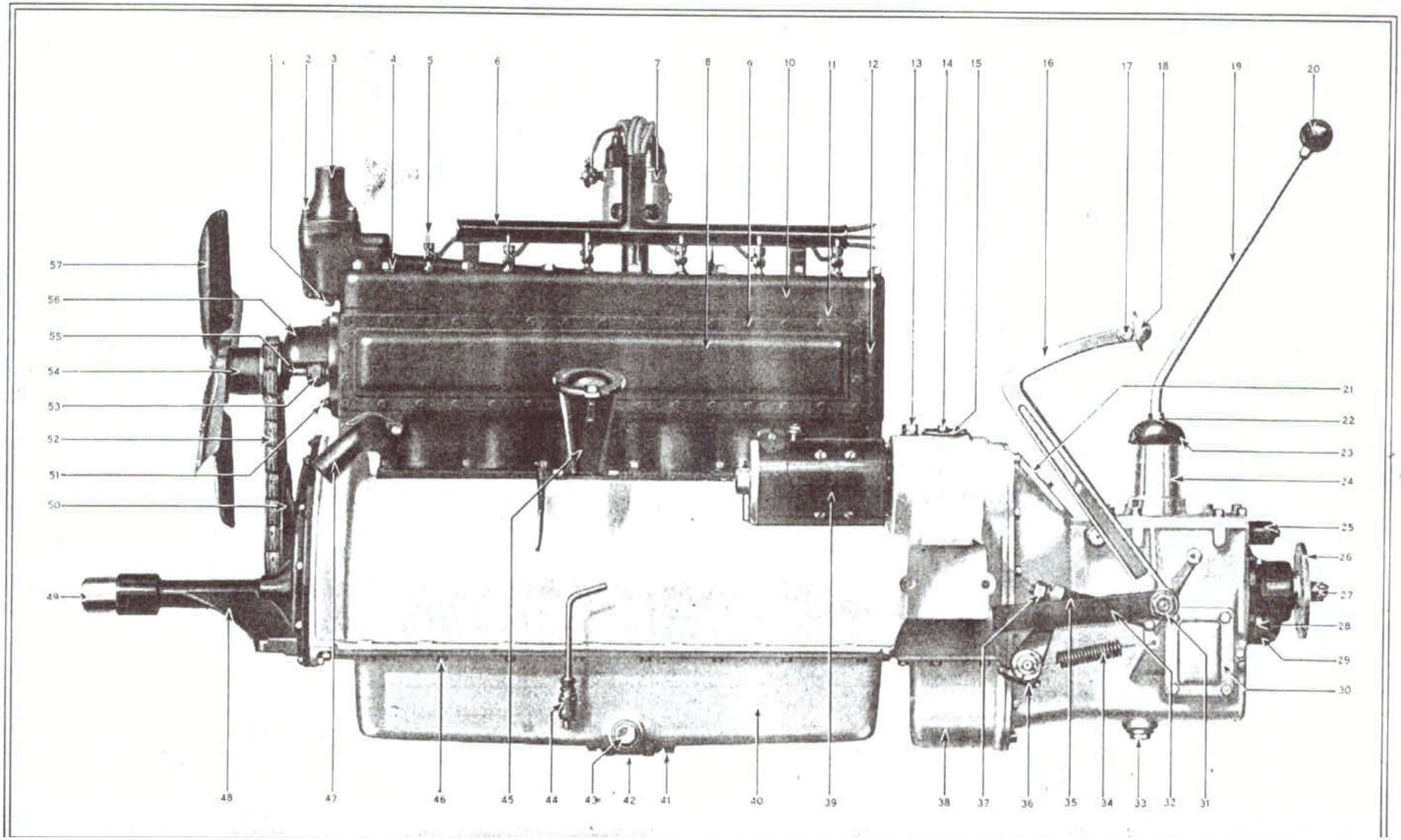
Remove the spark plugs and inject two or three tablespoonfuls of oil into each cylinder. Clean the plugs, dip the ends in oil and replace them in cylinders.

Crank the motor for twenty to thirty seconds, using the electric starter with the ignition switch off and the throttle closed, thus insuring a distribution of the oil over cylinder walls and valve mechanism.

Before putting the motor back into service after car has been stored, again remove the spark plugs, inject a small quantity of oil in each cylinder and crank the motor by hand for a few seconds with the ignition switch off. Then turn the ignition switch to "On" and after the motor has been started on its own power, it should be run slowly for a few minutes.

Battery

A battery that is not in service must be given attention at regular intervals. See "Storage of Battery," page 38.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57

Metal Parts

Exposed and unpainted metal parts of motor, body, and chassis should be well greased to prevent corrosion and rusting. This should be removed with gasoline before putting car back into service.

Storage of Tires

Tires that are out of service for any length of time should be removed from the rims. The inner tubes should be put in the casings, partially inflated and the tires stored in a moderately heated place away from the light. If tires are allowed to remain on the car, they should be partially deflated and the car jacked up so that no weight is allowed to rest on them or rapid deterioration will result.

Motor Features

General Principle

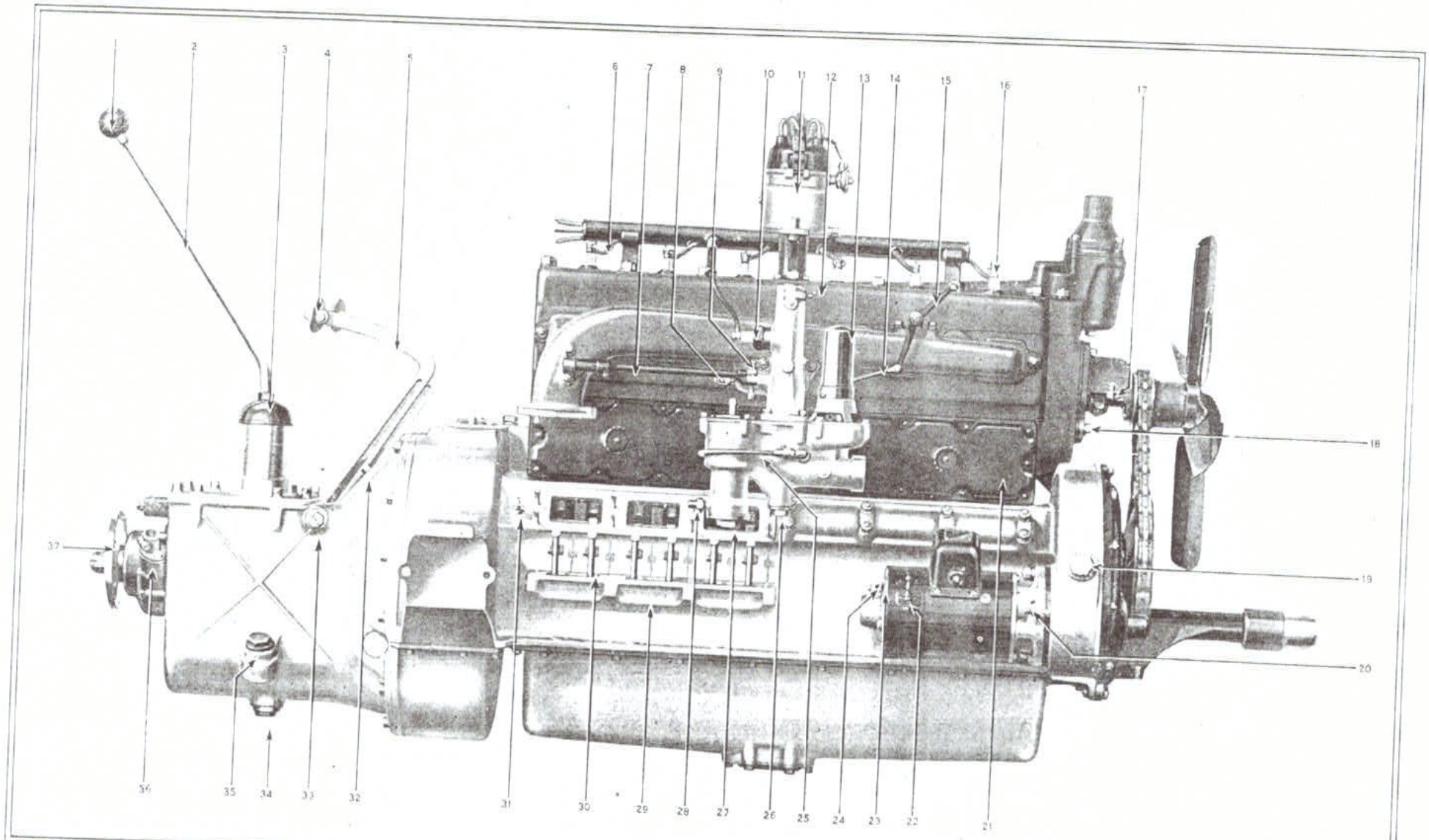
The Single Six motor is of the four cycle type, with the L head cylinders cast enbloc. The cylinder bore is 3⅜ inches and the stroke 5 inches. The valves are operated by rocker levers. These are operated by the cam shaft which is contained in the right side of the crank case.

Running a New Motor

Under no circumstances should a new motor be run at sustained high speed. Racing the motor unnecessarily is extremely injurious.

Plate No. 3—Motor Left Side

Ref. No.	Name of Part
1.	Thermostat sylphon nut
2.	Thermostat water outlet flange stud nut
3.	Thermostat water outlet flange
4.	Motor cylinder head stud nut
5.	Motor cylinder pet cock
6.	Ignition high tension cable tube
7.	Distributor
8.	Motor cylinder water jacket plate assembly
9.	Motor cylinder water jacket plate screw
10.	Motor cylinder head
11.	Motor cylinder head gasket
12.	Motor cylinder
13.	Motor starter screw
14.	Motor flywheel housing upper cover screw
15.	Motor flywheel housing upper cover
16.	Clutch pedal
17.	Clutch pedal pad screw
18.	Clutch pedal pad
19.	Change speed lever
20.	Change speed lever ball
21.	Transmission case inspection hole cover
22.	Change speed lever dust cover nut
23.	Change speed lever dust cover
24.	Transmission case cover
25.	Transmission gear shifter shaft stop cover
26.	Transmission driving shaft universal joint flange.
27.	Transmission driving shaft nut
28.	Transmission driving shaft rear housing cover stud nut
29.	Transmission driving shaft rear housing cover
30.	Transmission case tire pump hole cover
31.	Clutch and brake pedal shaft nut
32.	Clutch and brake pedal shaft support bracket
33.	Transmission case drain plug
34.	Clutch retracting spring
35.	Clutch shifter lever connecting rod adjusting spring
36.	Clutch shifter lever
37.	Clutch shifter lever connecting rod adjusting nut
38.	Motor flywheel housing
39.	Motor starter motor
40.	Motor crank case—lower half
41.	Motor oil strainer cover plate stud nut
42.	Motor oil strainer cover plate
43.	Motor crank case lower drain plug
44.	Motor crank case overflow valve
45.	Motor crank case oil filler and horn bracket assembly
46.	Motor crank case stud nut
47.	Motor cylinder water inlet flange
48.	Motor gear cover
49.	Motor starting crank shaft cap
50.	Motor cam shaft fan pulley
51.	Motor water pump clamp plate stud nut
52.	Motor fan belt
53.	Water pump shaft packing nut
54.	Motor fan pulley
55.	Motor water pump shaft
56.	Motor water pump body
57.	Motor fan


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

Maintaining Compression

Compression in all cylinders should be equal and up to the standard. Weakness or loss of compression is most probably due to imperfectly seated valves, which may be caused by insufficient clearance between the valve stems and lift rods, or by sticky valve stems and guides. The use of a poor or improper grade of lubricating oil or running with too rich a mixture may cause carbon deposits to collect in the cylinders and on the valve seat, preventing valves from seating properly. Compression should be tested for uniformity in all cylinders at regular intervals. This can best be done by rocking the motor against the compression of each cylinder by means of the hand crank. If the compression varies greatly between the various cylinders, the cause should be determined and remedied. The nearest Packard Service Station should be consulted when low compression is experienced.

Carbonized Cylinders

If the motor knocks easily under load, and does not seem to develop its normal amount of power, it is generally an indication that there is carbon in the cylinders.

To clean the carbon remove cylinder head according to the following directions:

Drain cooling system. Loosen top hose connection and remove. Remove distributor shaft, and connections. It will then be possible to raise the cylinder head which is secured to the cylinder block by studs. The carbon can then be easily removed with a scraper.

If it is desired to grind the valves at the time the head is off, full instructions may be obtained from the nearest Packard Service Station.

Valve Adjustment

Starting from the front of the motor the valves for the six cylinders are placed in the following order: No. 1 EX, 1 IN; 2 IN, 2 EX; 3 IN, 3 EX; 4 EX, 4 IN; 5 EX, 5 IN; 6 IN, 6 EX.

CAUTION: Before replacing the cylinder head, be sure that the cylinders are clean and entirely free from loose carbon or any other foreign substance. Also see that the cylinder head gasket is not broken or defective.

After the cylinder head and valves have been reassembled in accordance with the above instructions, retime the spark as explained on page 37.

Plate No. 4—Motor Right Side

Ref. No.	Name of Part
1.	Change speed lever ball
2.	Change speed lever
3.	Change speed lever dust cover nut
4.	Foot brake pedal pad
5.	Foot brake pedal
6.	Ignition high tension cable to spark plug No. 6 assembly
7.	Motor throttle valve control shaft
8.	Exhaust manifold to vacuum tank tube union connection
9.	Motor throttle valve shaft adjusting screw
10.	Motor fuelizer spark plug
11.	Distributor
12.	Motor fuelizer air adjusting screw
13.	Motor carburetor air valve cap
14.	Motor carburetor air valve rocker lever connecting rod assembly
15.	Motor carburetor air valve rocker lever
16.	Motor spark plug
17.	Motor water pump shaft bearing lubricator connector
18.	Motor water pump clamp plate stud nut
19.	Motor gear housing inspect hole plug
20.	Motor generator to crank case stud nut
21.	Motor valve cover plate
22.	Motor generator brush cover screw
23.	Motor generator third brush adjusting screw
24.	Motor generator rear bearing oiler
25.	Motor carburetor suction tube assembly
26.	Motor carburetor body plug
27.	Motor carburetor inlet strainer
28.	Motor carburetor gasoline inlet nipple
29.	Motor cam shaft rocker lever housing
30.	Motor cam shaft rocker lever
31.	Motor crank case oil pressure gauge connection
32.	Transmission case inspection hole cover stud nut
33.	Transmission gear shifter shaft lock plunger spring retainer
34.	Transmission case oil drain plug
35.	Transmission case oil level plug
36.	Speedometer driven shaft bushing
37.	Transmission driving shaft universal joint flange

The valve push rods should be so adjusted that the clearance between the lift tappet and the valve stem is .002 inch minimum for the inlet and exhaust valves when the motor is warm.

CAUTION: Insufficient clearance of the tappet to the valve stem will result in a riding valve when it becomes hot and lengthens thereby. Loss of power and rapid depreciation of the valve and valve seat follows.

Front End Chain

The cam shaft and generator shaft are driven from the crank shaft by a triangular drive silent chain with provision for adjustment.

Adjustments of the chain will ordinarily be necessary after about 1000 miles of running, after which adjustments will be required only when it becomes noisy. To inspect the chain, remove the inspection hole plug which is above the chain at the right forward end of the crank case.

If the combined forward and backward deflection of the chain at the inspection hole equals or exceeds one-half inch, the chain should be readjusted.

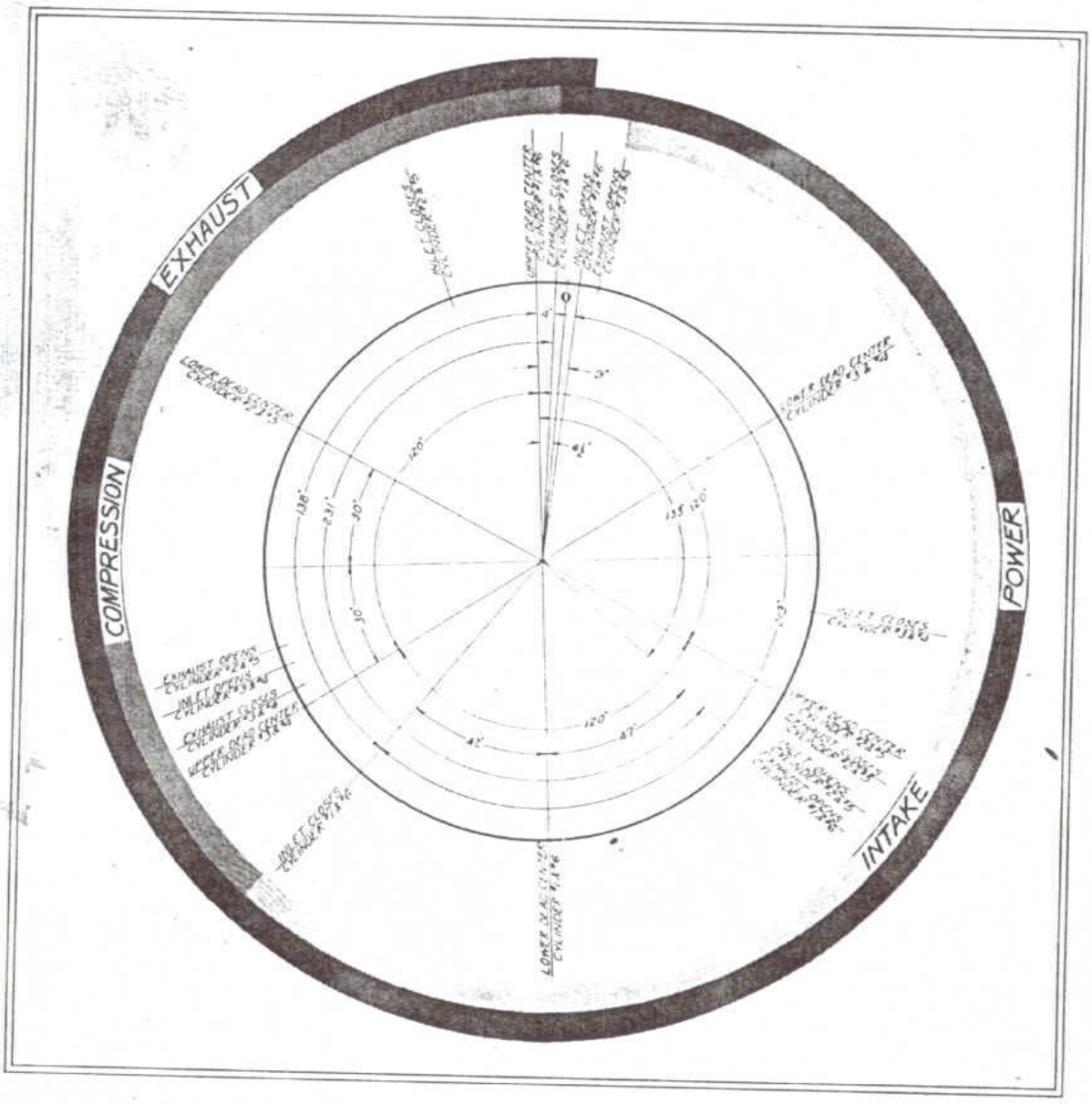


Plate No. 5—Valve Timing and Cycle of Operation

To adjust the chain, loosen the three nuts on the generator flange. The lower stud pivots the generator, making it merely necessary to move the top of the generator away from the motor until the chain has been properly adjusted. The proper tension can be determined by adjusting until a slight humming noise develops, and then slacking or backing up the adjustment until this noise disappears. Tighten the three nuts. A total deflection of one-eighth to one-quarter inch of the chain will result from this adjustment.

Setting the Cam Shaft

A change in the setting of the cam shaft is possible only by removal or disarrangement of the front end chain. Adjustments to the chain do not affect the valve timing.

In resetting the cam shaft the two teeth marked "O" on each of the crank shaft and cam shaft sprockets should be nearest together and lined up between the cam shaft and crank shaft centers. With the crank shaft gear in this position the top dead center mark on the flywheel for cylinders No. 1 and No. 6 will be on the dead center line of the motor.

Motor Lubrication System

Circulation of Oil

The oil is drawn from the crank case reservoir through the strainer located at the pump housing and is pumped to the main oil distributing manifold which is supported from the crank shaft bearing caps. From this manifold the oil is supplied to the seven main crank shaft bearings through holes drilled in the bearing caps. Independent oil passages in the crank shaft, leading from the main bearings, carry the oil to the connecting rod lower end bearings.

All cam shaft bearings are lubricated by oil which is forced through the hollow cam shaft from the oil lead running from the crank shaft rear bearing to the cam shaft rear bearing.

After passing through the hollow cam shaft and lubricating the four cam shaft bearings, the oil passes out through holes in the cam shaft sprocket onto the chain. The chain carries oil to the generator sprocket which also has holes leading the oil down to the generator shaft bearing. After these bearings are supplied with oil, the surplus drains back into the crank case oil reservoir.

The cylinder walls and piston pin bearings are lubricated by oil spray thrown from the lower end connecting rod bearings.

Holes drilled in the crank case allow the oil mist to rise into the valve compartments and lubricate the valve mechanism.

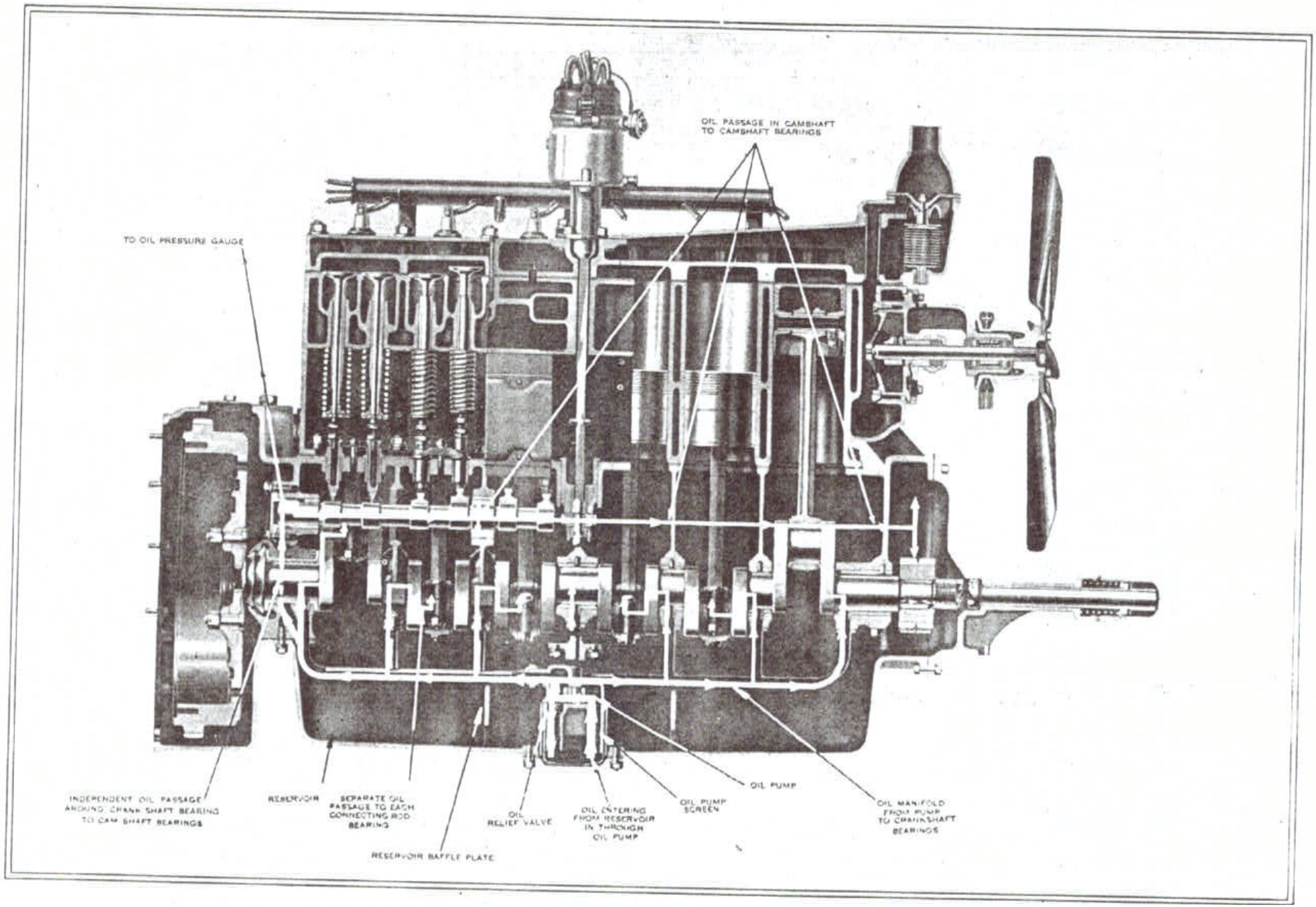
Baffle partitions located crosswise in the bottom of the crank case prevent the oil from surging.

Oil Supply

The oil supply is obtained by pouring oil directly into the crank case through the filler on the left side of the motor. Keep the crank case filled to the pet cock level.

The pet cock is operated by a rod through the crank case web on the left side of the motor.

CAUTION: About 1½ gallons are required to fill the crank case to the pet cock level. Do not carry an excess of more than 1 gallon of oil above this point as the connecting rods would be apt to dip, especially in hilly or rolling country. When touring, 1 gallon of oil may be added above the normal, or pet cock, level to make necessary less frequent stops for replenishment, as this will not be required until the level in the crank case falls below the pet cock.


OIL PASSAGE IN CAMSHAFT TO CAMSHAFT BEARINGS
TO OIL PRESSURE GAUGE
INDEPENDENT OIL PASSAGE AROUND CRANK SHAFT BEARING TO CAM SHAFT BEARINGS
RESERVOIR
SEPARATE OIL PASSAGE TO EACH CONNECTING ROD BEARING
RESERVOIR BAFFLE PLATE
OIL RELIEF VALVE
OIL ENTERING FROM RESERVOIR IN THROUGH OIL PUMP
OIL PUMP SCREEN
OIL PUMP
OIL MANIFOLD FROM PUMP TO CRANKSHAFT BEARINGS

When driving a good deal every day and running up mileage rapidly on a tour in warm weather, it should not be necessary to drain the crank case and replace the oil under two weeks as under these conditions the deterioration of the oil is very slow in comparison to the mileage of operation.

Do not put oil into the front end compartment through the plug opening at the right of the front end of the crank case. This opening is intended only as a means of inspecting the front end chain.

Oil Pressure

The gauge on the instrument board should show from 20 to 35 pounds oil pressure with the motor warm and running at 900 R. P. M., and not less than two pounds pressure at 300 R. P. M., corresponding to a speed of about twenty-two and seven miles per hour respectively, with the standard rear axle ratio and the motor warm.

Failure of the gauge to show pressure after the motor has been running for a few minutes is an indication of lack of oil or clogging of the cylindrical strainer or oil pipes.

The motor should be stopped immediately and the cause determined. Insufficient or excessive pressure on the gauge may indicate improper adjustment of the oil relief valve.

When the motor is cold, the pressure will be higher until the oil thins down. During extremely cold weather the oil may show excessive pressure, due to congealing of oil in the pipes, which prevents free circulation. Running the motor slowly for a few moments, will give the oil a chance to warm up and become thinner.

Motor Oil Pump

A gear pump located at the lowest point of the crank case forces oil from the reservoir to the main oil distributing manifold, which is attached to the crank shaft bearing caps.

The pump is operated by a shaft driven by a spiral gear on the cam shaft. It may be removed for cleaning or inspection by taking off the lower half of the crank case and unscrewing the nuts which hold it to the bottom of the upper half and disconnecting the oil manifold. No adjustment of pump gears is required. The oil pressure is regulated by means of the oil pump relief valve which is accessible through a cover plate in the bottom of the crank case lower half.

Oil Relief Valve

The oil relief valve is contained in the pump body. It is controlled by the tension of a coiled spring which should be set to the proper pressure, see page 23. The inlet to the relief valve is connected with the pump discharge passage, and any excess pressure causes the valve to open and allows the oil to return to the inlet of the pump.

To raise the oil pressure, drain all oil out of motor and remove oil pump cover plate on bottom of crank case; remove the cotter pin from the adjusting stud and increase the spring tension by turning the adjusting screw clockwise with a screw driver.

To lower the pressure, the spring tension should be decreased. Be sure the cotter pin is replaced before the cover is put on the crank case.

Oil Strainers

The oil is strained before entering the pump and manifold, through a cylindrical strainer around the entire pump. It should be cleaned whenever the supply of oil in the crank case is changed. This can be done by removing the small plate on the bottom of the crank case lower half.

Changing Oil in Crank Case

The oil should be drained from the crank case and replenished with a fresh supply every five hundred miles during the first two thousand miles of running. This will insure proper lubrication of the motor while the parts are new. After the first two thousand miles it is necessary to change the oil only every one thousand miles in the summer and every five hundred miles in the winter, unless a test shows that the oil has lost its original viscosity before this time. A simple and sufficiently accurate method of testing the viscosity of oil is to rub a small quantity of it between the thumb and finger, and compare it with the feel of new oil under the same test.

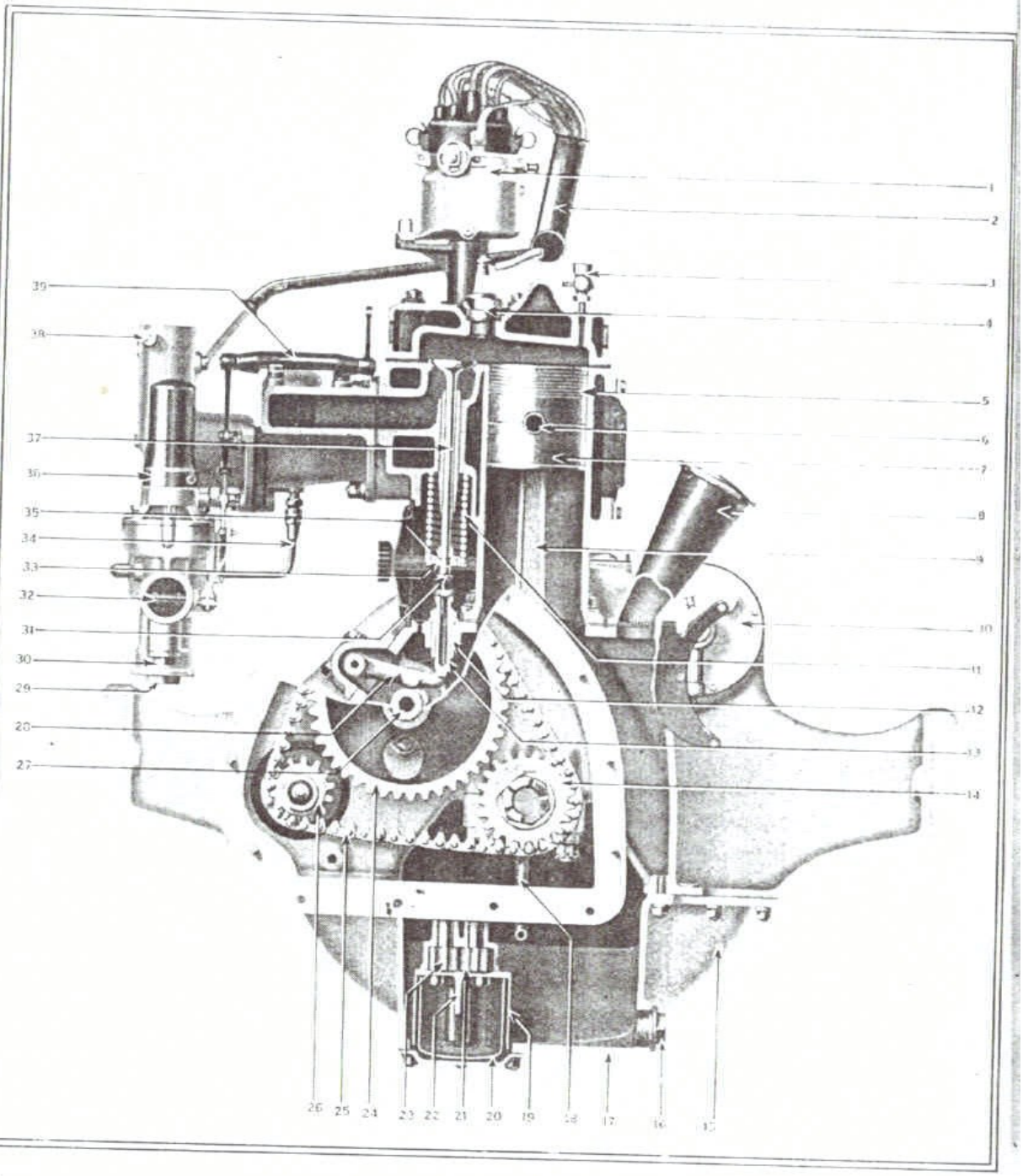


Plate No. 7—Motor, Front View

The oil may be drained by removing the drain plug at the bottom of the left side of the crank case. After draining, thoroughly clean strainer. Do not run motor with kerosene in the system.

Do not run motor until the crank case has been refilled with fresh oil to the pet cock level. About 1½ gallons will be required to bring the oil to this point.

Insufficient Lubrication

If through an oversight, the motor does not receive proper lubrication and begins to heat or to knock, it should be stopped immediately.

Allow the motor to cool. Bring the oil in the crank case reservoir up to the pet cock level. Fill the radiator with water after the motor is thoroughly cooled.

Run the motor slowly, making sure that the proper oil pressure is indicated by the gauge.

Should there be apparent damage, the motor should be thoroughly inspected without further driving.

Gasoline System

General Principle

The gasoline supply is carried in the main tank at the rear of the frame. From there it is drawn to a vacuum tank on the dash, by suction from the engine. From the vacuum tank it flows to the carburetor by gravity.

The main supply tank is equipped with a gauge which shows the supply of fuel at all times. The capacity of the tank is 19 gallons.

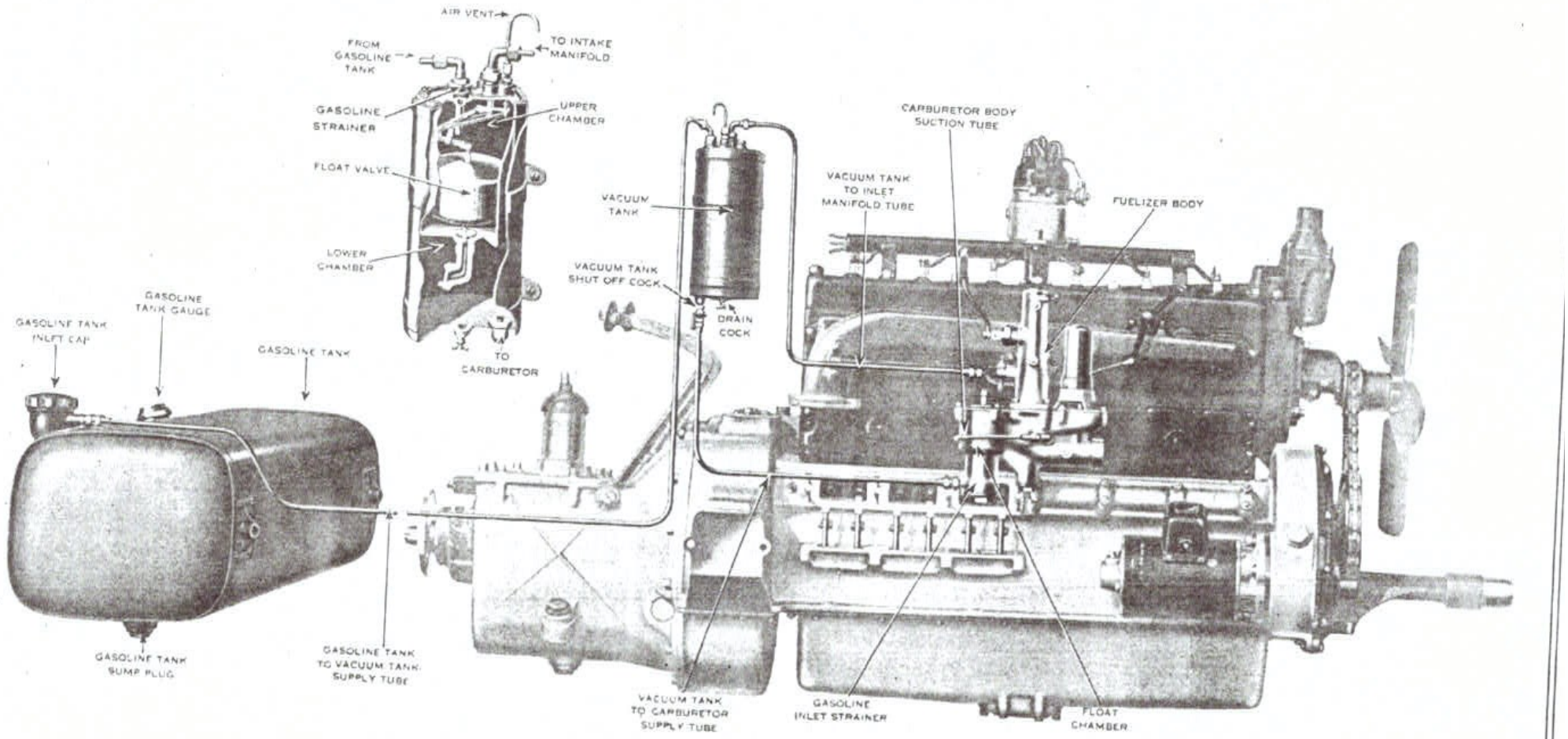
Vacuum Tank

The vacuum tank has three connections, two at the top and one at the bottom. The lower connection leads to the carburetor, the upper ones to the main gasoline supply tank and to the intake manifold of the engine respectively.

The tank consists of two chambers. The upper chamber contains a float which operates, through levers, two valves, one in the suction line from the intake manifold and the other to an atmosphere vent which leads into the

Plate No. 7—Motor Front View

Ref. No.	Name of Part
1.	Distributor
2.	Ignition high tension cable tube
3.	Motor cylinder pet cock
4.	Motor spark plug
5.	Motor piston ring
6.	Motor piston pin
7.	Motor piston
8.	Motor crank case oil filler and horn bracket assembly
9.	Motor connecting rod assembly
10.	Motor starter motor
11.	Motor valve spring
12.	Motor valve push rod guide
13.	Motor valve push rod
14.	Motor crank shaft sprocket
15.	Motor flywheel housing
16.	Motor crank case lower drain plug
17.	Motor crank case lower half
18.	Motor oil manifold assembly
19.	Motor oil pump cover casing
20.	Motor oil pump strainer assembly
21.	Motor oil pump driven impeller
22.	Motor oil pump body cover
23.	Motor oil pump shaft
24.	Motor cam shaft sprocket
25.	Motor cam shaft driving chain
26.	Motor generator sprocket
27.	Motor cam shaft
28.	Motor cam shaft rocker lever
29.	Motor carburetor inlet strainer plug assembly
30.	Motor carburetor body plug
31.	Motor valve push rod adjusting screw
32.	Motor carburetor air shutter
33.	Motor valve spring seat key
34.	Motor carburetor suction tube assembly
35.	Motor valve spring seat
36.	Motor carburetor air valve spring cap
37.	Motor valve exhaust
38.	Motor fuelizer air adjusting screw
39.	Motor carburetor air valve rocker lever shaft bracket


AIR VENT
FROM GASOLINE TANK
TO INTAKE MANIFOLD
GASOLINE STRAINER
UPPER CHAMBER
FLOAT VALVE
LOWER CHAMBER
TO CARBURETOR
VACUUM TANK
VACUUM TANK SHUT OFF COCK
DRAIN COCK
CARBURETOR BODY SUCTION TUBE
VACUUM TANK TO INLET MANIFOLD TUBE
FUELIZER BODY
GASOLINE TANK INLET CAP
GASOLINE TANK GAUGE
GASOLINE TANK
GASOLINE TANK SUMP PLUG
GASOLINE TANK TO VACUUM TANK SUPPLY TUBE
VACUUM TANK TO CARBURETOR SUPPLY TUBE
GASOLINE INLET STRAINER
FLOAT CHAMBER

upper chamber of the tank. When there is no gasoline in the upper chamber, the float is down, the valve communicating with the atmosphere closed and the valve in the suction line open. With the engine running, suction will draw gasoline from the supply tank and fill the upper chamber of the vacuum tank. This causes the float to rise which in turn opens the atmospheric vent and closes the suction line. The gasoline now passes into the lower chamber where it feeds to the carburetor by gravity, allowing the float in the upper chamber to drop slowly. This causes the suction valve to open again and the operation is repeated. The lower chamber is open to the atmosphere at all times so that a steady flow of gasoline to the carburetor is assured.

Care of the Vacuum Tank

The vacuum tank requires very little attention. The drain cock at the bottom of the tank should be opened periodically and a small quantity of gasoline drained, depending upon the amount of sediment in it; also clean the small screen at the top of the vacuum tank directly under the connection leading to the gasoline tank in the rear. If there is gasoline in the main supply tank but none reaches the carburetor, disconnect the pipe leading to the carburetor from the vacuum tank. If gasoline flows from this pipe, it is an indication of dirt or water in the carburetor and if it does not flow, the passage through the pipe itself may be clogged or the vacuum tank may be empty.

In order to fill the vacuum tank after it has been emptied, close the throttle and turn the motor over with the starter. If the motor does not start in 20 to 30 seconds, close the pet cock below the vacuum tank and continue cranking for another 20 to 30 seconds. If the tank still does not fill, remove the plug in the top of the vacuum tank and pour in about a pint of gasoline.

Water in Gasoline Line

In cold weather, water introduced with the gasoline is liable to cause trouble by freezing in the gasoline pipes.

If this trouble develops, the gasoline system should be allowed to thaw out and then drained by removing the motor carburetor inlet strainer plug assembly, opening the drain cock under the vacuum tank and removing the drain plug in the main supply tank.

Carburetor and Fuelizer

The carburetor is mounted on the right side of the motor and supported from an intake elbow which contains the fuelizer. The carburetor is of the automatic float feed type with a two-stage spray nozzle and a cylindrical mixing chamber.

To ascertain whether or not the carburetor is receiving gasoline, remove the screw cap on the float chamber cover and raise the needle valve stem thus exposed. Gasoline should issue here almost immediately. This floods the carburetor and should therefore not be continued after gasoline once appears.

Function of the Fuelizer

The fuelizer heats the gasoline and air from the carburetor so that the mixture enters the cylinders as a dry gas rather than a combination of air and liquid particles.

This is accomplished in the following manner: A small fraction of the gasoline and air mixture passing to the engine is shunted into a passage in the intake elbow which leads to the burning chamber of the fuelizer. This mixture is ignited by the spark plug in the side of the fuelizer or intake elbow and burns

with a steady flame which can be viewed through the inspection glass on top of the fuelizer. The flame heats the manifold metal and then the hot burned gas mixes with the charge going to the engine from the carburetor. The application of heat to the ingoing mixture greatly improves its gasification which is particularly important at the lower throttle openings at which time the fuelizer supplies its maximum heat.

The color and condition of the flame is the index to the operation of the fuelizer. It should be observed with the motor idling. A steady bluish-green flame indicates a good mixture. If at any time an improper mixture is obtained, adjustment can be made by admitting either more or less air to the burning chamber by means of the small needle valve at the top. If the opera-

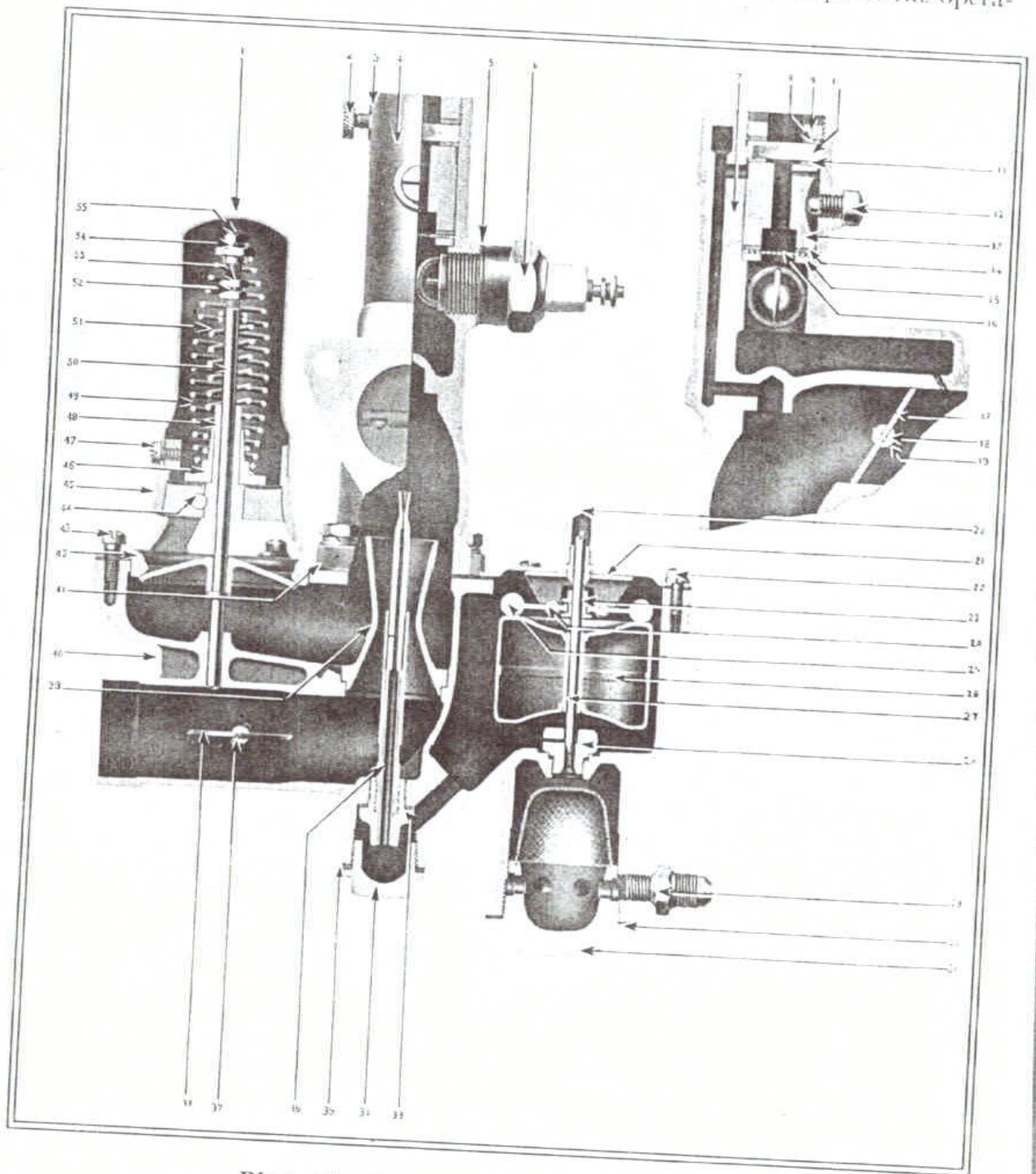


Plate No. 9—Carburetor and Fuelizer

tion is still unsatisfactory, remove the plug above the inspection glass, the glass and screen retainer which is held by a set screw at the rear; clean the screen and glass and also the spark plug and replace parts exactly as they were. The fuelizer is tested and adjusted before the car leaves the factory and no further adjustment should be necessary.

Gasoline economy is little affected one way or the other, except that in cold weather a somewhat increased gasoline mileage may be noted with the fuelizer in operation.

Float Chamber

The gasoline enters the float chamber of the carburetor through the inlet strainer which should be cleaned occasionally. A constant level or supply of gasoline is maintained by the float, thereby regulating the height of the gasoline in the two-stage spray nozzle which is directly connected with the float chamber.

The gasoline flows into the float chamber through a needle valve, automatically operated by the action of the float. Pivoted balance levers resting on the top of the float open and close the needle valve according to the movement and position of the float.

Mixing Chamber and Intake Manifold

The mixing chamber is a cylindrical passage, in which the gasoline atomizes and mixes with the air before being drawn into the cylinders.

The gasoline after leaving the float chamber enters the spray nozzle which is located in the center of the mixing chamber.

The suction created by the pistons causes air to enter the mixing chamber through both primary and auxiliary air inlets and in passing around the spray nozzle draws the gasoline from it, atomizing and mixing the gasoline with air.

Plate No. 9—Carburetor and Fuelizer

Ref. No.	Name of Part
1.	Motor carburetor air valve spring cap
2.	Motor fuelizer air adjusting screw
3.	Motor fuelizer air adjusting screw nut
4.	Motor fuelizer body
5.	Motor fuelizer spark plug gasket
6.	Motor fuelizer spark plug
7.	Motor fuelizer body
8.	Motor fuelizer inspection plug gasket
9.	Motor fuelizer inspection plug
10.	Motor fuelizer inspection glass
11.	Motor fuelizer inspection plug gasket
12.	Motor fuelizet screen retaining plug set screw
13.	Motor fuelizer screen retaining plug
14.	Motor fuelizer screen seat gasket
15.	Motor fuelizer screen seat
16.	Motor fuelizer screen
17.	Motor throttle valve
18.	Motor throttle valve shaft
19.	Motor throttle valve shaft screw
20.	Motor carburetor float chamber needle valve cap
21.	Motor carburetor float chamber cover assembly
22.	Motor carburetor float chamber cover screw
23.	Motor carburetor float chamber needle valve collar
24.	Motor carburetor float balance weight pivot
25.	Motor carburetor float balance weight
26.	Motor carburetor float assembly
27.	Motor carburetor float chamber needle valve
28.	Motor carburetor float chamber needle valve seat
29.	Motor carburetor gasoline inlet nipple
30.	Motor carburetor inlet strainer washer
31.	Motor carburetor inlet strainer
33.	Motor carburetor spray tube gasket
34.	Motor carburetor body plug
35.	Motor carburetor body plug gasket
36.	Motor carburetor spray tube assembly
37.	Motor carburetor air shutter shaft
38.	Motor carburetor air shutter
39.	Motor carburetor spray mixing tube
40.	Motor carburetor body
41.	Motor carburetor to fuelizer gasket
42.	Motor carburetor air valve seat
43.	Motor carburetor air valve seat screw
44.	Motor carburetor air valve cam shaft and lever assembly
45.	Motor carburetor air valve seat
46.	Motor carburetor air valve cam collar
47.	Motor carburetor air valve spring cap screw
48.	Motor carburetor air valve seat
49.	Motor carburetor air valve spring—large
50.	Motor carburetor air valve assembly
51.	Motor carburetor air valve spring—small
52.	Motor carburetor air valve spring nut
53.	Motor carburetor air valve spring nut
54.	Motor carburetor air valve spring adjusting nut
55.	Motor carburetor air valve spring adjusting nut lock nut

Primary Air Intake

The primary air intake contains a shutter which is normally open and not in use when running. This shutter is operated by the carburetor control on the instrument board, which also operates the auxiliary air valve and is used to choke the motor for starting when cold. By pulling the carburetor control all the way out, the primary air intake is completely closed, allowing a very rich mixture to be drawn into the cylinders. The control should be pushed in, at least part way, as soon as the motor has started firing.

Auxiliary Air Valve

The auxiliary air valve is in a housing forward of the mixing chamber and is controlled by the tension of two springs, one of which is within the other.

At low motor speed most of the air is admitted through the primary air intake around the spray nozzle.

To prevent too rich a mixture at greater throttle openings, the auxiliary air valve is opened because of the increase in suction.

The carburetor thus automatically produces a more nearly correct mixture for all motor speeds, than could be obtained by manual control.

The normal running position for the carburetor auxiliary air valve is attained when the carburetor control is up against the instrument board. The motor while cold, however, will require a richer mixture initially than after it has become warm by running. This rich mixture may be obtained by keeping the control two or three notches out. Due to the thermostatic control and the fuelizer action, the motor warms up very rapidly and the control should not be allowed to remain out of normal running position any longer than is necessary.

If convenient, idle a cold motor after it has been started before running the car. By allowing the motor to heat up in this way, it will pull with greater efficiency when put under load.

Too rich a mixture supplied to a motor will cause a waste of gasoline, an accumulation of carbon, and may seriously interfere with the proper lubrication of the cylinder walls.

CAUTION: When supplied with too rich a mixture, either through choking the carburetor too much in starting or through operating the motor with the carburetor control too far out, the motor is liable to refuse to run. To overcome this "loading," open throttle and crank the motor by the starter and with the carburetor control pushed against the dash. After the cylinders are blown out, partially close throttle and start the motor in usual way being careful not to "load it up" again by injudicious use of the carburetor control.

Auxiliary Air Valve Adjustment

Permanent adjustment of the auxiliary air valve is made by changing the tension of the air valve springs. These springs which control the action of the valve are, in addition, adjusted for temporarily varying operating conditions by means of a cam operated by the carburetor control on the instrument board.

The proper adjustment for normal running conditions is obtained when the carburetor control is against the instrument board. To enrich the mixture, pull the control out as required.

The auxiliary air valve itself should be adjusted to the leanest possible mixture at which the motor will idle properly when hot. The dash adjustment should be pushed all the way in and the valve, when depressed to the point where it touches the inside spring, should have a drop of $\frac{5}{32}$ inch from its seat.

To check, proceed as follows:

Push the carburetor control all the way in. Measure height of top of air valve stem from some fixed point on the motor. Depress air valve until it strikes inside spring. Measure height of top of stem as before. The difference in these two measurements is the air valve drop.

The outer spring should be adjusted so that the valve just touches its seat when the carburetor control is against the dash. Then with the motor warm reduce the compression of this spring as much as possible, retaining smooth motor operation.

Make sure that air adjusting connecting rod clevis is so adjusted that the air shutter completely closes when the carburetor control on the instrument board is pulled all the way out.

CAUTION: In warm weather, or if the motor is warm, the mixture may be so rich if the carburetor control is pulled out too far that the charge will not ignite and the surplus of unburned gasoline may interfere with the proper lubrication of the cylinder walls.

Suction Tube

A suction tube leads from the base of the spray mixing tube around the carburetor into the intake manifold. The function of this tube is to prevent loading of the motor when it is idled or driven by the car in coasting with the clutch engaged. This is accomplished by the tube collecting the gasoline which collects in the carburetor body due to condensation. It also prevents loading under continued low throttle driving and aids in giving immediate response in acceleration. Failure of the suction tube to function properly is evidenced usually by gasoline dripping from the carburetor and by loading of the motor as described. The cause of failure would be air leakage into the tube or connections, or, more frequently, clogging of the passage way either in the tube or in the carburetor body. The best way to clean this passage way is to remove the tube and blow it out, together with the lower elbow connection on the drilled leads in the carburetor, with compressed air.

Throttle Valve

The throttle valve is of the butterfly type and is located in the fuelizer elbow above the spray nozzle. It is controlled by a hand lever on the steering wheel and by the accelerator pedal.

An adjustable stop screw holds the throttle valve slightly open and allows a small amount of mixture to reach the motor cylinders with the hand throttle lever, above the steering wheel, in the closed position. The minimum amount of mixture for idling the motor is thus supplied.

To increase the minimum speed, loosen the check nut and turn the set screw to the right. To decrease the speed, back off the set screw.

Carburetor Control

The throttle of the carburetor may be operated either by means of the throttle lever on the steering wheel sector or the accelerator pedal.

The accelerator pedal is the usual means of controlling the speed of the car. Its action is instantaneous and when released the motor resumes the speed determined by the position of the hand throttle lever setting.

The accelerator pedal is set to have a clearance of $\frac{3}{16}$ inch between pedal and top of floor board when throttle is wide open.

A clearance is necessary in order to obtain the full range of throttle opening

Ignition System

Low Tension Circuits

The ignition system is of the single wire or grounded return type. The source of current is the generator, which charges a storage battery. The positive battery terminal is grounded. The negative terminal is connected to the motor starter switch. From the terminal on the starter switch, the low tension current is carried to the terminal marked "BAT" on the forward face of the dash wiring board. On the rear side of the dash this terminal connects with the negative side of the ammeter. From the positive ammeter terminal the circuit leads to terminal No. 1 on the back of the ignition switch and a second lead connects the ammeter positive terminal with the dash wiring board post marked "AM+." The low tension current leaves the switch at No. 3, running to the ignition coil which it enters at "POS" and leaves at post "NEG." A low tension wire from this coil carries the current to the terminal on the interrupter housing and then to the resistance coil and interrupter for motor and fuelizer ignition.

Ignition Interrupter

The breaker in the distributor unit completes the low tension circuit when the breaker points are in contact. When the points separate, the instantaneous clearing of the low tension current from the primary winding of the coil induces a high tension current in the secondary windings which surround the primary winding. One secondary winding serves the cylinder spark plugs and the other serves the fuelizer spark plug.

The high tension current is conducted to the cylinder spark plugs through the distributor head, and the current for the fuelizer spark plug is carried directly to it from the coil.

The breaker mechanism consists of a set of circuit breaker points. These are operated by a six-lobed cam mounted on the top of a vertical shaft which is driven at cam shaft speed. This causes the low tension circuit to be broken three times to each revolution of the crank shaft.

Arcing across the contact points when they are separating is minimized by the use of a condenser, located in the ignition timer and distributor housing. Indirectly the condenser also serves to intensify the high tension current wave. A resistance unit in the low tension circuit, located on the side of the timer housing serves to keep the low tension current down to the proper rate of flow.

The circuit breaker points of the ignition apparatus unit should be kept smooth and parallel, with a clearance of from .020 to .025 inch between them when fully separated. A feeler for adjusting these points and of the proper thickness is attached to the ignition breaker and distributor wrench.

High Tension Circuits

The high tension motor ignition passes from the terminal "Engine" on the front of the coil to the center terminal of the distributor head, thence through the distributor to the proper spark plug. The high tension current after jumping the spark plug gap, completes the circuit through the grounded low tension circuit, the beginning of the secondary winding for the motor ignition circuit and the secondary winding for the fuelizer ignition circuit both being connected to the primary winding. The fuelizer secondary or ignition current leads directly from the terminal "Fuelizer" on the coil to the fuelizer spark plug.

High Tension Distributor

The distributor is mounted on top of the ignition head located on the cylinder head. Its function is to direct the secondary current produced by the action of the breaker points, coil primary current, etc., to the proper cylinder. This is accomplished by means of a rotor which contacts with leads to the spark plugs according to the firing order of the motor.

The distributor has no connection with the fuelizer. In addition it is driven by the breaker cam so that corrections in timing are automatically made on the distributor rotor.

Firing Order

The firing order is 1-5-3-6-2-4, numbering the cylinders in succession, beginning with number one at the front of the motor.

Switch

The ignition switch on the instrument board has two positions. A low tension circuit can be completed through the breaker points when the switch handle is turned to its upward position and the battery current may flow continuously. The car should, therefore, never be left with the switch in this position.

A key lock permits the switch to be locked only in the off or lower position, and for reasons of safety and convenience, this should be done whenever the car is left.

Spark Advance

The point at which ignition occurs in the cylinders relative to piston travel is automatically controlled within the driving range, by a centrifugal governor in the ignition apparatus. This is accomplished by varying the angular relation between the timer shaft and crank shaft. This relation may be further affected by operating the spark lever located above the steering wheel at the left side, which has the effect of bodily shifting the entire range of action of the automatic spark advance.

For starting and ordinary running, the hand advance lever should be carried within one inch of full advance. For extremely low speed it is advisable to carry this lever somewhat farther back, and for extremely high speed in the fully advanced position. For maximum economy above fifteen miles per hour the lever should be fully advanced, but on heavy pulls this may cause an objectionable detonation condition in the motor, in which event it may be temporarily retarded.

Spark Setting

The spark setting in the fully advanced position should be two inches measured on the circumference of the flywheel before upper dead center. Should it become necessary to check this, proceed as follows:

Remove the toe board, flywheel housing cover, distributor head and rotor. Set the spark lever on the steering wheel in the fully advanced position. Open all priming cups with the exception of the one in No. 1 cylinder. Crank the motor by hand until compression begins in this cylinder, then open this priming cup and continue to crank the motor slowly to the point where the curcuit breaker just begins to separate. Visual determination of the separation of the breaker points is not accurate enough and it is advisable to use the following procedure:

Turn the ignition switch on and watch the ammeter as the motor is slowly hand-cranked with pet cocks open. At the instant of breaker point separation

the ammeter reading will fall to zero current flow. All circuits in the electrical system should of course be open when this check is being made.

In this position, the marking "Upper D. C. Cylinder 1 and 6" on the flywheel should have two inches to travel before reaching the center line of the motor, as indicated on the flywheel housing.

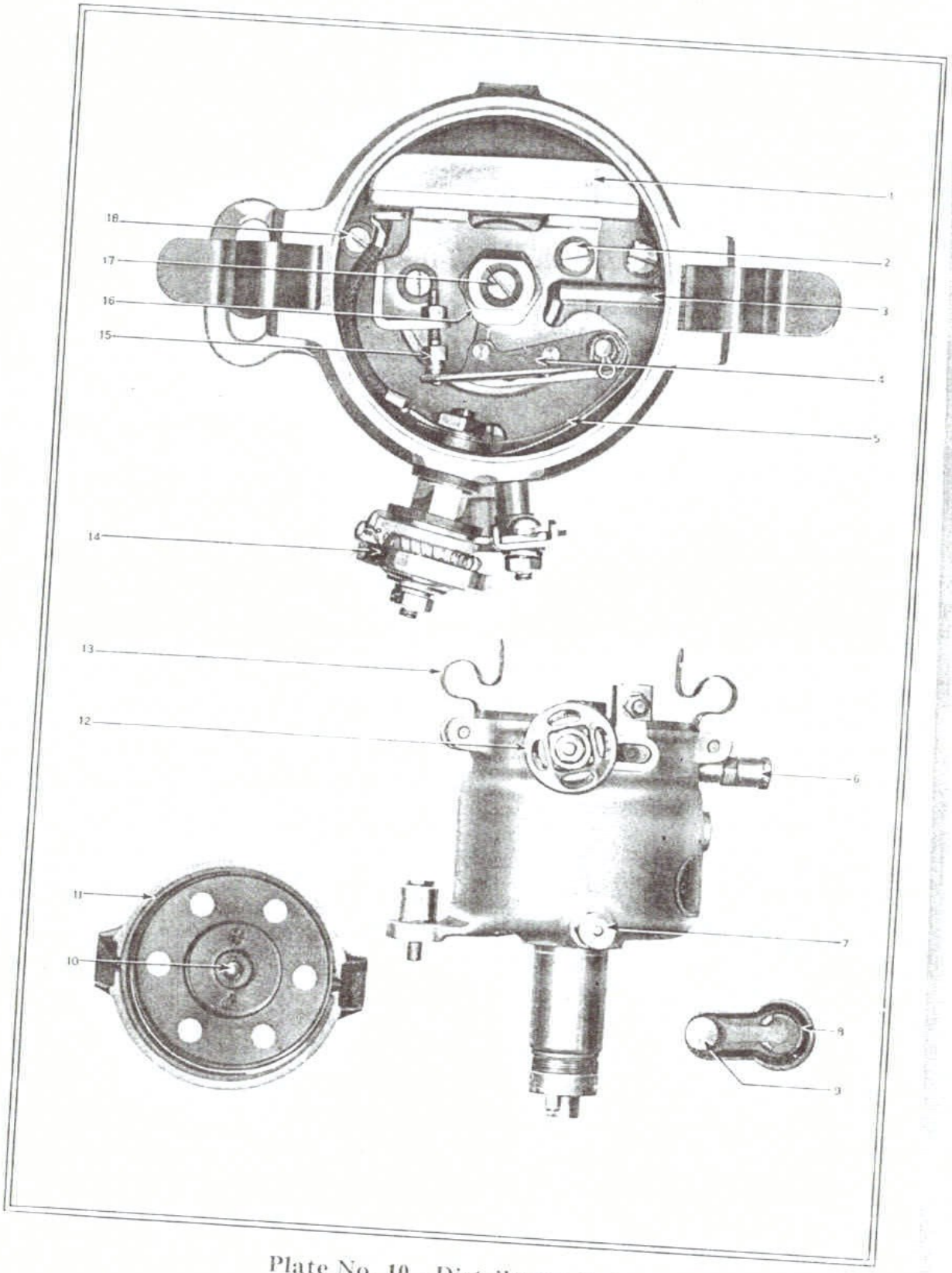


Plate No. 10 —Distributor Unit

Replacing the Complete Ignition Apparatus

If the ignition apparatus has been removed for any reason, it may be replaced, providing the motor has not been disturbed or rotated, nor the ignition apparatus itself changed from the position it held when removed. Generally however, it will be advisable to proceed upon the basis that something may have altered its position slightly.

In this event hand crank the motor to No. 1 cylinder compression—see page 35 and stop with "upper D. C. cylinder 1 and 6" two inches to go before reaching the dead center mark on the flywheel housing.

Remove the distributor head from the ignition apparatus and rotate the distributor rotor until its position corresponds with the position of No. 1 terminal on the distributor head.

Keep the lever, which is at the bottom of the ignition apparatus, in its rear position.

The ignition unit may now be set in place and all connections made.

Any necessary adjustments for connections can be made on the adjustable clevis at one end of the inclined spark control rods.

Complete oiling instructions for the ignition distributor are given on Page 9

Retiming of the Spark

Retiming the spark should not be necessary unless previous disassembling has caused disarrangement of related parts.

In order to retime the spark, set the flywheel as explained under "Spark Setting" with the spark lever in the full advanced position and the ignition apparatus bolted to the cylinder head. Remove the distributor head and lift out the rotor. With a screw driver loosen the screw in the center of the six-lobed cam. The cam can then be turned so that the ignition interrupter is just opening when the position of the rotor coincides with the position of the terminal marked No. 1 on the distributor head. Tighten the cam without moving it and recheck the setting as explained under the paragraph "Spark Setting." Page 35.

Spark Plugs

The ignition spark jumps across a gap between the center point, or electrode, and the point connected to the body of the plug. These points should be adjusted with a gap of $\frac{1}{32}$ of an inch between them. Improper adjustment of the spark plugs will impair the efficiency of the motor and may cause it to miss fire.

A $\frac{1}{32}$ of an inch gap gives a good spark for slow running and for hard pulling, and is the best all around adjustment obtainable.

The spark plug should be kept free from carbon which otherwise will cause short circuiting. The plug points may be cleaned with fine sand paper. It is also a good plan to wash the plugs occasionally in gasoline. The carbon

Plate No. 10—Distributor Unit

Ref. No.	Name of Part
1.	Distributor condenser assembly
2.	Condenser bracket screw
3.	Distributor bearing oiler—upper
4.	Distributor interrupter lever assembly
5.	Distributor interrupter spring
6.	Distributor bearing oiler—upper
7.	Distributor bearing oiler—lower
8.	Distributor brush holder assembly
9.	Distributor brush
10.	Distributor head brush
11.	Distributor head
12.	Distributor resistance unit
13.	Distributor head spring
14.	Distributor resistance unit
15.	Distributor interrupter contact screw
16.	Distributor interrupter cam
17.	Distributor interrupter cam adjusting screw
18.	Bracket screw

which collects in the recess surrounding the porcelain should be thoroughly cleaned out to avoid short circuiting.

The plug cannot be disassembled. The center electrode is insulated from the body of the plug with porcelain. If this becomes cracked, the plug should be replaced as otherwise it will ignite the mixture in the cylinder irregularly if at all.

Fuelizer Spark Plug

The fuelizer spark plug is of an entirely different type than used for motor ignition, and the two types should never be interchanged except that in an emergency a cylinder spark plug with a widened gap may be used in the fuelizer until the proper replacement can be made. Rapid depreciation of the plug and faulty fuelizer action must be expected in a short time under this condition however. The difference in the designs of the two spark plugs is due to differences in operating temperatures, mixtures and pressure conditions in the fuelizer and cylinder combustion chambers.

The fuelizer spark plug functions in the same manner as the ignition plugs and should receive same attention. The gap, however, is $\frac{1}{8}$ inch.

Starting and Lighting System

The starting and lighting system is of the single wire type, the units being grounded. In other words, the return connection is made through the various metal parts of the chassis. The current is furnished by a storage battery which is charged by a generator operated by the motor. A heavy cable leads from the starter motor and is connected to the negative battery terminal through the starter switch and the other, the positive battery terminal, is grounded. The current for lighting and ignition is correspondingly taken directly or indirectly from the positive battery terminal.

The Battery

The simplest and most reliable method for gauging the condition of the storage battery is to test each cell with a hydrometer. When the battery is fully charged a reading of about 1.280 specific gravity will be obtained in each cell. If the driving conditions have been such as to insure an adequate amount of charging from the generator and one or more cells constantly register below 1.200, the nearest service station of the battery manufacturer should be consulted.

The battery is common to the ignition, starting and lighting systems. It is composed of three cells, and is 6-volt with a capacity of 100 ampere hours. The negative terminal is connected to the starter switch and the positive is grounded.

The battery is located in a battery case under the front floor boards inside of the frame. It is kept in place by holding-down bolts at each end, the nuts of which should be tightened just enough to hold the battery firm. To disconnect the battery, loosen the bolts of the conductors so that the terminal plugs may be pulled off.

In ordinary service the battery should require no other attention than to keep the liquid $\frac{1}{4}$ inch over the tops of the plates, adding only distilled water as required. Never add acid.

CAUTION: Outside of isolated cases of overcharging, undercharging, excessive discharging etc., the common cause of battery failure is neglect on the part of the operator to add or have added the required distilled water. This should be done every two weeks in the winter and every week in summer. On touring or other heavy mileage work attention is required more frequently.

This further guards against unforeseen breakdowns of the battery, as unusual or irregular water consumption may be used as a warning to have the battery inspected at the maker's service station.

If the battery should become discharged from allowing the car to stand with lights burning, ignition switch left on, or from any other cause, it should be given a recharge immediately.

A fully discharged battery will freeze at about twenty degrees above zero.

A battery that is three-fourths discharged will freeze at about zero.

Storage of Battery

When placing car in storage it is best to remove the battery and have it stored at a charging station where it will receive proper attention.

If it is stored with the car, it should be recharged about every six weeks, either from an outside source or by allowing the motor to run at a charging speed for three to four hours.

For full information regarding the care of the battery, when not in service, consult the Service Department of a Packard Distributer or the Service Station of the battery manufacturer.

The Generator

The generator is carried at the front end of the motor on the right side. On top of the generator is mounted a small box which contains the relay to which the negative generator lead is connected. The positive side of the generator is grounded. In removing the generator do not remove the bronze housing into which the generator fits. The sprocket which drives the generator is mounted on this bronze housing and its removal would necessitate replacing the front chain on the generator sprocket and the sprocket on the bronze housing, and resetting the cam shaft.

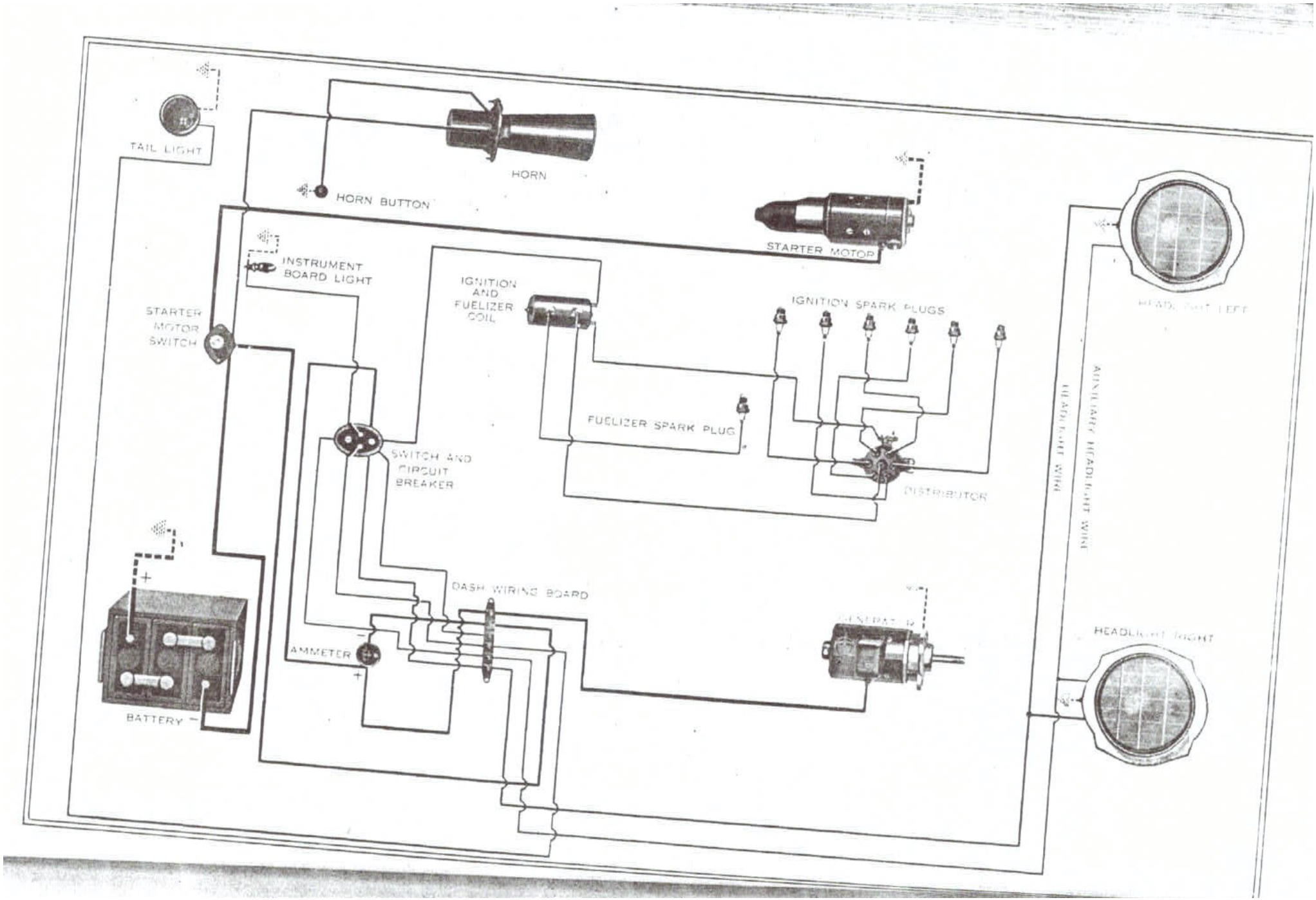
CAUTION: Do not run the motor with the generator or the battery wire disconnected. An attempt to do this may cause serious trouble by either burning out the lamp bulbs, damaging the generator or running down the battery.

Regulation of Generator

The generator is automatically regulated to furnish a constant current output at all speeds except for very low speeds. There is also a slight decrease at high speed. This is obtained by exciting the field with current received from one main brush and a third brush. For ordinary service an output of 9 to 11 amperes registered on the ammeter is satisfactory. When the car is driven slowly a large percentage of the time, or if the lights are used extensively, it is desirable to increase this output to not more than 13 amperes. These ampere readings apply only when all lamps are turned off, that is, when all circuits on the car except the charging and ignition ones are open. On the other hand, if the lights are seldom used or if a rather high average speed is maintained, it may be desirable to lower the output to 4 or 6 amperes.

The winter charging rate should be higher than the summer rate. The changing of the rate can be quickly performed at the nearest Packard Service Station. High battery water consumption is usually an indication of high charging rate. Low battery charge usually indicates a low charging rate. See the previous page for testing battery gravity.

To adjust the output of the generator, remove the band around the brush compartment. Loosen the stud which holds the third regulating brush, which is the uppermost one, in place. Loosen also the screw on the outside of end of the generator.


TAIL LIGHT
HORN
HORN BUTTON
STARTER MOTOR
INSTRUMENT BOARD LIGHT
IGNITION AND FUELIZER COIL
IGNITION SPARK PLUGS
STARTER MOTOR SWITCH
FUELIZER SPARK PLUG
SWITCH AND CIRCUIT BREAKER
DISTRIBUTOR
DASH WIRING BOARD
AMMETER
BATTERY
HEADLIGHT LIGHT

By moving the brush counter clockwise when looking at the free end of the generator the current output is increased, and by rotating it clockwise it is decreased.

CAUTION: The car should not be driven with the storage battery removed and using dry cells for the ignition current. If this is done serious injury to the electrical system will result.

Lighting System

Lighting

All electrical light appliances derive their current through the large cable leading from the battery to the starting switch. The other end of both lighting system and battery wires are grounded to complete the circuit.

Wiring for tail and body lights is carried in a flexible conduit attached to the right frame member. The disconnector for the body lights is on the inside of the right frame member, near the intermediate cross channel.

Headlight and auxiliary wires are carried in flexible metal conduits leading up to the back of the headlights. The circuits lead from the negative terminal of the battery, through the various terminals, switch, circuit breaker, etc., to the headlight bulbs which are grounded, thus completing the circuit through the headlight, headlight brackets, frame, etc., to the grounded side of the battery.

Lamp Sizes

Headlights	7-volt, 21 Cp.
Auxiliary	7-volt, 6 Cp.
Instr. Bd	7-volt, 2 Cp.
Tail lamps	7-volt, 2 Cp.
Dome Light (Closed bodies)	7-volt, 8 Cp.

The lamp bulbs have the "Ediswan" base and are of the "Single Contact" type.

Circuit Breaker

The circuit breaker is located on the back of the switch on the instrument board. This protective device takes the place of the usual fuses. The normal lighting current does not affect the circuit breaker but if a short circuit should occur causing a heavy current to flow it would operate the circuit breaker causing it to make a clicking noise, which will continue until the short circuit has been eliminated, which should be done as soon as it can be located. An additional effect of the circuit breaker in action is a flickering of the lights.

Tail Lamp Wiring

The tail and license lamp is so wired that it can either be turned on by a switch on the control board or by a revolving switch at the back of the lamp.

In states (as Illinois) requiring the tail light to be turned on and off at the lamp, the tail light wire on the dash wiring board should be connected to the terminal marked "Ill. Tail."

Ammeter

The ammeter is located on the instrument board. It is connected between the generator, lighting and ignition circuits and the battery and indicates the amount of current flowing into or out of the battery.

When the engine is running the ammeter registers the amount of charging current passing from the generator to the storage battery. If the ammeter fails to register when the lights are off and the car traveling over 12 miles per hour, look for loose connections or broken wires between generator and battery. See that generator commutator is clean and that brushes are making good contact. When the engine is not running or idling, the ammeter will register the amount of current flowing to lamps or ignition should these switches be on.

Relay

The relay is located on the top of the generator. It is an automatic switch which closes the circuit between the generator and the battery when the generator speed is sufficient to begin furnishing current, and automatically opens when the speed of the generator is too low to furnish current, or the motor stopped.

A discharge on the ammeter with the lights and ignition off and the motor stopped indicates a short circuit or a stuck relay. In the latter event the relay points may be separated by hand but should be smoothed up and adjusted or replaced at once.

Electric Starter

The System

The electric starting system consists of a cranking motor, the storage battery also common to lighting and ignition systems, and a starting switch.

Starter Motor

The starter motor is located on the left side of the engine at the rear. The motor shaft carries a sleeve provided with a helical thread on which is carried a threaded pinion.

When motion is imparted to the shaft of the starter motor, it causes the pinion to advance and mesh with the flywheel. When the engine starts and the flywheel speed exceeds that of the starter motor the pinion is disengaged from the flywheel automatically.

Operation of Starter

Adjust the carburetor control, on the instrument board, according to instructions on page 5.

Set the spark lever to the normal running position which is within 1 inch of fully advanced. Turn the ignition switch on. Press down the starter button as far as it will go. Hold the button down until the engine starts firing, when it should be instantly released. Never press button down while engine is running.

A heavy drain is thrown upon the battery whenever it is used for starting purposes. If the motor does not start readily, do not attempt to start it by continued cranking. Release the button and locate the trouble. It may be due to an improper setting of the carburetor control on instrument board, no gasoline, switch turned off, loose or broken wire connections or other causes. Continued cranking may cause battery trouble. "Loading" of the motor due to excessive choking will also frequently cause failure to start. See page 32.

In the event of any electrical trouble consult the nearest Packard Distributer. Do not attempt any repairs or allow local electricians to tamper with the electrical equipment as the maker's responsibility ceases where such repairs have been attempted.

NOTE: When the starter motor does not turn the motor and after initial click makes no indication of receiving current, the trouble may be due to the starter driving pinion jamming on the flywheel teeth. If this is suspected (it would be impossible to hand crank the motor), turn off ignition switch, engage high gear and clutch and rock the car by means of a rear wheel. On the reverse rock the pinion will back free from the flywheel teeth and the car should be rolled forward about two feet, after which the motor may be started in the regular way.

The Starter Switch

The starter switch is attached to the inclined toe board at the center. The button protrudes through the inclined toe board. The heavy cable on one side of the switch is fastened to a terminal on the top of the starter motor, the other starter button terminal is connected to the battery. Pressure on this button closes the circuit, allowing current to flow to the starter motor.

Removing Starter

To remove the starter, disconnect the heavy cable at the terminal on top of the starter motor. Remove the cap screw in the flywheel housing just above the starter motor. The unit can then be pulled forward.

Cooling System

Water Circulation

The heat generated in the motor must be dissipated in order to permit the motor to function properly. This is accomplished by providing water jackets cast integral with the cylinder block through which water is circulated by means of a centrifugal pump.

Water is drawn from the bottom of the radiator and the pump and then forced through the water inlet manifold, which is in the form of a cover plate on the left of the cylinder block, to the cylinder water jacket. The outlet from the jacket is through the thermostat, then through the upper hose connection to the top of the radiator. The thermostat by-pass is a drilled lead in the cylinder head. For the action of the thermostat see page 45.

The Radiator

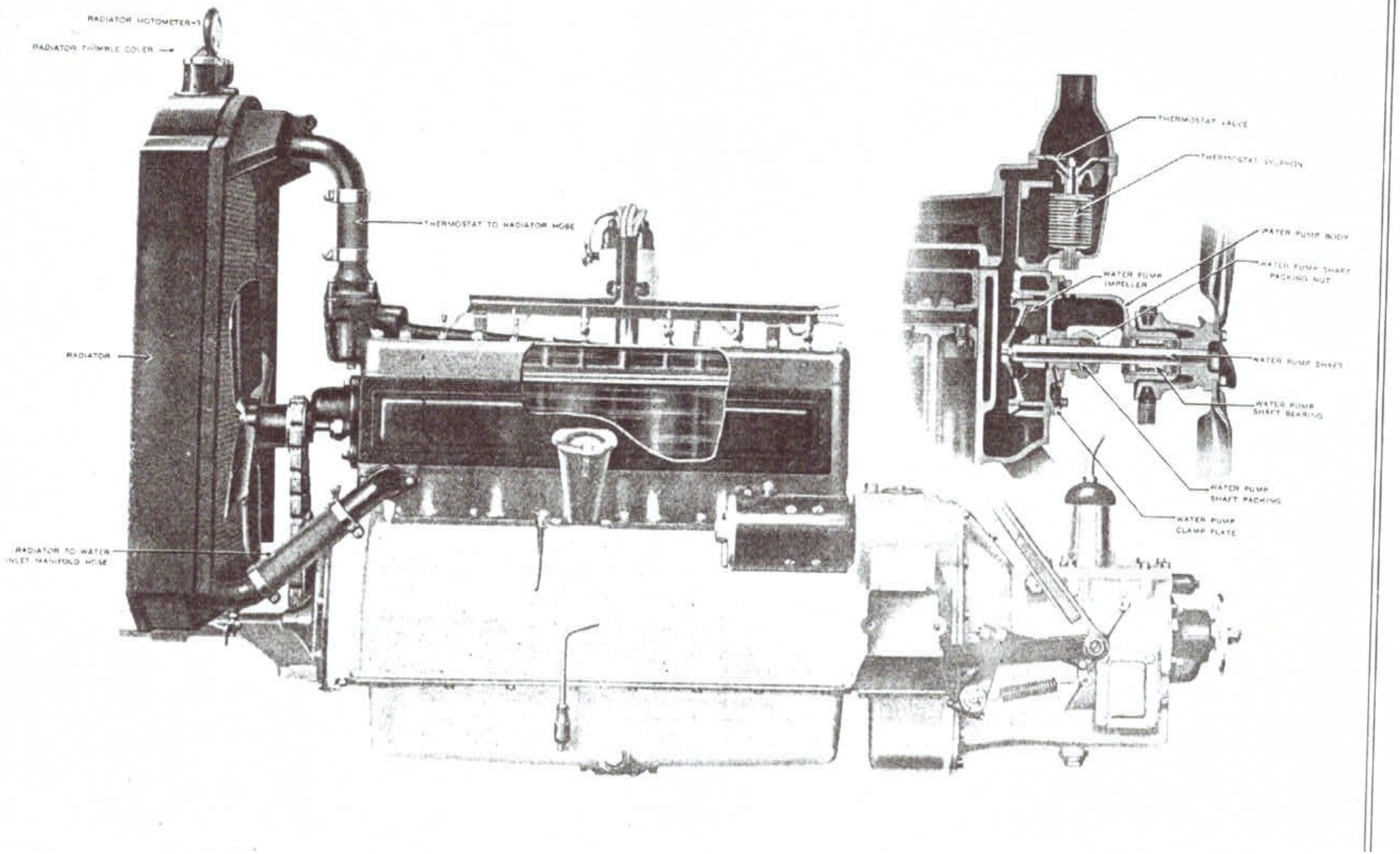
The water is cooled by flowing through the radiator through which a current of air is drawn by the fan.

The radiator is of the ribbon type, and the radiator core through which the water passes is independent of the outer shell and is easily removable should any repairs be necessary.

Keep the cooling system filled with water as free from lime and other impurities as is possible.

Any steam or surplus water will escape through a vent pipe, extending from beneath the filler cap to the lower right corner of the radiator. The emission of steam is generally an indication of a low water supply or an overheated motor, but may also be caused by a frozen radiator or clogging of the water system. See anti-freeze solutions on page 46.

CAUTION: Avoid pouring water into an empty or nearly empty water system when the motor is hot. On a cold day the emission of steam from the radiator overflow does not indicate the presence of sufficient water to continue operating the motor. On the contrary it may indicate only that the cooling system is clogged by ice. Stop the motor and thaw out the entire system, fill with anti-freeze solution to give proper protection against freezing, and then proceed.


RADIATOR HOTOMETER
RADIATOR THIMBLE COVER
THERMOSTAT TO RADIATOR HOSE
RADIATOR
RADIATOR TO WATER INLET MANIFOLD HOSE
THERMOSTAT VALVE
THERMOSTAT SYPHON
WATER PUMP BODY
WATER PUMP IMPELLER
WATER PUMP SHAFT PACKING NUT
WATER PUMP SHAFT
WATER PUMP SHAFT BEARING
WATER PUMP SHAFT PACKING
WATER PUMP CLAMP PLATE

Water Pump

A centrifugal water pump is mounted at the forward end of the cylinder block of the motor. The water pump housing is cast integrally with the cylinder block. The pump contains a centrifugal impeller which is driven by the fan belt. An adjustable gland nut on the front of the pump shaft permits the packing to be kept tight and prevents leakage. The forward end of the water pump shaft is carried on a roller bearing. This bearing is lubricated through a lubricator connector which is located on the side of the pump housing.

Thermostat

The thermostat, located at the forward end of the cylinder head, by-passes the water, cutting out the radiator until it has reached the proper temperature to permit efficient running of the motor. A drilled by-pass in the cylinder head connects the thermostat housing with the intake side of the pump. Valves controlling the entrance to the radiator and the by-pass tube are carried on a shaft actuated by the thermostat sylphon.

When the motor is cold, the radiator valve is closed and the by-pass valve is open, allowing the water to circulate through the pump and back to the pump without entering the radiator. As the water becomes heated the expansion of the sylphon causes the radiator inlet valve to open, and at the same time closes the by-pass valve, making it necessary finally for all water to circulate through the radiator, when the motor has become thoroughly warm.

No adjustment to the thermostat is necessary.

Moto-Meter

A moto-meter attached to the radiator filler cap indicates the temperature of the water in the cooling system.

Overheating is generally due to running with an improper mixture, insufficient spark advance, carbonized cylinders, fan belt slipping, radiator not filled, anti-freeze solution in radiator in warm weather, radiator or cylinder water jackets clogged with scale or rust, or insufficient lubrication.

Fan Belt

A belt-driven fan placed directly behind the radiator draws a current of air through the radiator to increase the cooling efficiency.

Adjust the fan belt as follows: Loosen the four nuts on the front end of the water pump. Rotate the water pump cover which is mounted eccentrically, thereby making it possible to either increase or decrease the tension of the belt. If the four nuts are slacked off too much, water leakage will be excessive when adjusting the fan belt. This can be eliminated by draining the cooling system partially before making the adjustment. The belt should be tight enough so that by grasping the rim of the fan it will be just possible to slide the belt on the pulley. It is very important that this belt be reasonably tight, but care should be taken not to place excessive tension on it.

A new belt should be adjusted after the first 500 miles. When the initial stretch has been taken up it will require little attention thereafter.

A new belt should be installed by breaking the connection between two of the links which are connected by screws and reassembling it with the belt in place.

Draining the Water System

To drain the water from the entire system, open the drain cock at the bottom of the radiator on the left side.

If the car is not to be used during freezing weather, the water circulation system should be thoroughly drained. After the water has ceased flowing run the motor for a minute or two to be sure that the system is entirely cleared of water.

Cleaning the Water System

The radiator and cylinder water jackets should be flushed occasionally to remove any sediment which may accumulate.

To clean the radiator, remove the hose connections and flush by forcing water under city pressure through it from the bottom to the top. Avoid excessive pressure. The cylinder water jackets should be thoroughly cleaned and flushed at times of overhaul.

CAUTION: Do not use chemicals in the process of cleaning the cooling system. If strong enough to aid the process materially they will also attack certain parts of the system and it is very difficult to remove them entirely when the cleaning is completed.

Cold Weather Care

During cold weather, provision should be made to insure the proper efficiency of the water circulation system, and all leaks removed.

The cooling system should be thoroughly drained and filled with anti-freezing mixture at the beginning of freezing weather.

Anti-Freezing Mixture

At the outset of freezing weather, drain the water circulation system thoroughly and fill with one of the following anti-freeze solutions. About 4½ gallons are required.

For a temperature not lower than 5° below zero:

Alcohol	15 per cent
Glycerine	15 per cent
Water	70 per cent

For temperature not lower than 15° below zero:

Alcohol	17 per cent
Glycerine	17 per cent
Water	66 per cent

Alcohol should be added occasionally to make up for evaporation. Glycerine does not evaporate.

NOTE: If unable to obtain glycerine, a solution of thirty per cent alcohol and seventy per cent water may be used.

A simple solution of alcohol, while in no way injurious, lowers the boiling point of the water. Consequently, on warm days with the car standing and the motor running, the solution will boil easily and evaporate. The boiling point of denatured alcohol is about ten degrees higher than that of wood alcohol. The use of glycerine raises the boiling point of the solution. It is more expensive than alcohol and is slightly injurious to rubber. All things considered, however, a combination of alcohol, glycerine and water is most satisfactory.

Do not use a solution of calcium-chloride or any alkaline solution, these being injurious to the metal parts, and in addition are liable to clog the cooling system if the water of the solution is inadvertently allowed to reduce through evaporation.

CAUTION: If the water in the radiator should become frozen on account of not containing a strong enough solution, run the motor only enough to get it warm and cover the radiator over entirely until it thaws out. A better procedure still, is to get the vehicle into a warm place and allow it to thaw out.

Transmission and Clutch

General Principle

The motor unit includes the clutch and transmission assemblies. The latter are enclosed in a housing attached to the rear end of the crank case casting. The transmission case contains a selective gear set giving three speeds forward and one reverse. The driving torque is transmitted to the spiral bevel driving gears in the rear unit through a shaft with a universal joint at each end. The final drive is through the differential and live axle shafts to which the rear wheels are keyed.

The Clutch

Attached to the flywheel and enclosed in a housing which forms an extension of the transmission case, is a multiple disc clutch. It consists of two series of dry plates which are alternately connected with a casing attached to the flywheel and a gear on the clutch shaft. The driving plates are faced with special friction material which contacts with the steel driven plates.

The clutch plates are held in contact by the tension of eight coil springs. Pressure upon the left pedal compresses the springs and allows the plates to separate slightly by sliding endwise on their respective teeth, which causes disengagement of the clutch.

Care of the Clutch

Do not slip the clutch to reduce the speed of the car or to partially relieve the load from the motor. Use the throttle or shift to the next lower gear.

The clutch plates are run dry. They are unaffected by atmospheric conditions and in service require no lubrication or other attention.

Clutch Pedal

Do not "ride" the clutch pedal—that is, hold the foot against it when driving steadily as there is a possibility of keeping it partially out of engagement and causing slippage which will result in undue depreciation of the frictional surfaces. In addition this practice throws a continuous load on the clutch shifter bearing and causes it to wear more rapidly.

See that clutch pedal is properly adjusted in the engaged position.

When the clutch is in the fully engaged position, the pedal should depress one-half inch under light spring pressure before resistance of the heavy clutch springs is encountered.

If the pedal is brought against the floor board before the clutch is entirely engaged, full action of the clutch springs is not obtained which will cause the clutch to slip and depreciate rapidly.

The rod connecting the clutch pedal with the clutch release lever on the left of the clutch housing gives the necessary means for obtaining the correct adjustment for the clutch pedal. Lengthening the rod by means of the adjusting nut will increase the amount of travel before the clutch disengages.

No other change from the original adjustment will be required as clutch springs are automatic in the compensation for wear of the frictional surfaces.

Action of Speed Changing Gears

A splined driving shaft carries two sliding gears, actuated by a pair of gear shifter forks. These gears engage with countershaft gears for first and second speeds, and a constant mesh idler for reverse. Third speed or direct drive is obtained by coupling the second speed gear to the end of the clutch shaft. The sectional view of the transmission shows the gears in the neutral position.

In this position with the motor running and the clutch engaged all gears are in motion with the exception of the direct drive first and second speed gears which are fitted by means of splines to the main transmission driving shaft. The forward end of the main shaft is mounted in a roller bearing located on the inside of the clutch shaft gear.

First speed is obtained by sliding the larger or first speed and reverse gear forward into mesh with the first speed countershaft gear. This permits the car to be driven forward at the greatest transmission gear ratio, through the constant mesh gears, at the front of case, and the countershaft and first speed gears.

Second speed is obtained by sliding the smaller or second speed and direct drive gear back into mesh with the second speed countershaft gear. Third speed or direct drive is obtained by sliding the smaller driving shaft gear forward until the internal teeth in this gear engage with the outer ends of the teeth on clutch shaft gear, thereby locking both shafts together for direct drive.

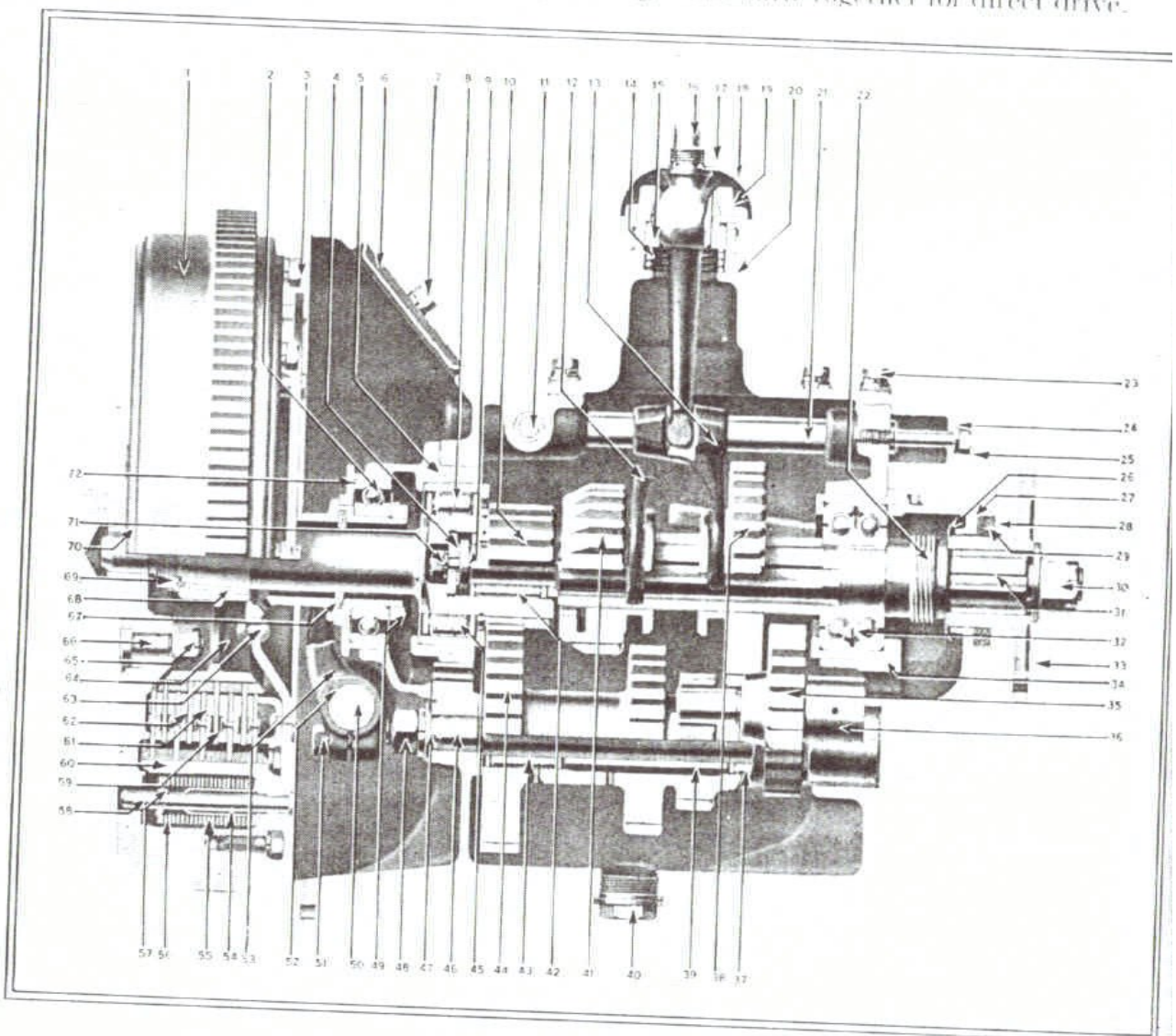


Plate No. 13—Transmission and Clutch Section

For reversing the drive the larger transmission driving shaft gear is brought back into mesh with the reverse idler pinion, which is in constant mesh with the small gear at the rear end of the countershaft. The drive is then through the constant mesh gears at the forward end of the transmission case, the countershaft and the reverse idler pinion which is in mesh with both the countershaft gear and the driving shaft gear. This arrangement causes the main driving shaft to be revolved in the reverse direction.

While it is possible to shift from any one gear to another without going through an intermediate gear, it is necessary in each case to bring the shifter lever through the neutral position. This brings the sliding gears out of engagement and in making the next shift the sliding gear that is not to be used is automatically locked in the neutral position.

Cleaning Transmission

It is a good plan to drain the oil from the transmission after about every 10,000 miles of running and to flush out the case with kerosene. The case should then be refilled to the filling plug level with good transmission fluid oil.

Cold weather has the effect of thickening the lubricant, and it may be diluted with enough cylinder oil to bring it to its summer consistency. If the oil is too thick, increased difficulty will be found in shifting gears.

The drain plug is located in the bottom of the transmission case and the level plug on the right side.

Plate No. 13—Transmission and Clutch Section

Ref. No.	Name of Part
1.	Motor flywheel
2.	Clutch shifter thrust bearing
3.	Clutch casing screw
4.	Transmission driving shaft thrust button washer
5.	Clutch shaft bearing rear housing
6.	Transmission case inspection hole cover
7.	Transmission case inspection hole cover screw
8.	Clutch shaft rear bearing roller assembly
9.	Transmission driving shaft thrust button
10.	Clutch shaft
11.	Transmission gear shifter shaft interlocking plunger
12.	Transmission gear shifter fork
13.	Transmission gear shifter fork
14.	Change speed lever ball socket spring
15.	Change speed lever ball socket—lower
16.	Change speed lever
17.	Change speed lever dust cover nut
18.	Change speed lever dust cover
19.	Change speed lever ball socket—upper
20.	Transmission case cover
21.	Transmission first and reversing gear shifter fork shaft
22.	Speedometer driving gear
23.	Transmission case cover screw
24.	Transmission gear shifter shaft stop cover
25.	Transmission gear shifter shaft stop plate screw
26.	Transmission driving shaft bearing rear oil thrower
27.	Transmission driving shaft bearing rear housing cover
28.	Transmission driving shaft bearing rear dust washer retainer
29.	Transmission driving shaft bearing rear dust washer
30.	Transmission driving shaft nut
31.	Transmission driving shaft
32.	Transmission driving shaft ball bearing rear
33.	Transmission driving shaft universal joint flange
34.	Transmission driving shaft bearing rear housing
35.	Transmission reversing pinion
36.	Transmission reversing pinion pin
37.	Transmission counter shaft bearing
38.	First speed and reversing gear
39.	Transmission counter shaft bearing spacer
40.	Transmission case oil hole plug
41.	Direct drive and second speed gear
42.	Transmission driving shaft bearing—front
43.	Transmission counter shaft bearing
44.	Transmission counter shaft gears
45.	Clutch shaft rear bearing roller assembly
46.	Transmission counter shaft
47.	Transmission counter shaft washer
48.	Transmission counter shaft nut
49.	Clutch shifter thrust bearing nut
50.	Clutch shifter fork shaft
51.	Clutch shifter fork screw
52.	Clutch shifter fork key
53.	Clutch shifter fork
54.	Clutch spring bushing
55.	Clutch spring
56.	Clutch spring seat
57.	Clutch spring seat retainer
58.	Clutch spring guide
59.	Clutch spider plate
60.	Clutch casing
61.	Clutch casing plate
62.	Clutch casing plate facing
63.	Clutch casing plate pressure ring plate rivet
64.	Clutch spider
65.	Motor flywheel flange bolt nut
66.	Motor flywheel flange bolt
67.	Clutch shifter thrust bearing sleeve
68.	Clutch spider key
69.	Clutch spider nut
70.	Clutch shaft bushing—front
71.	Driving shaft thrust button nut
72.	Clutch shifter thrust bearing housing

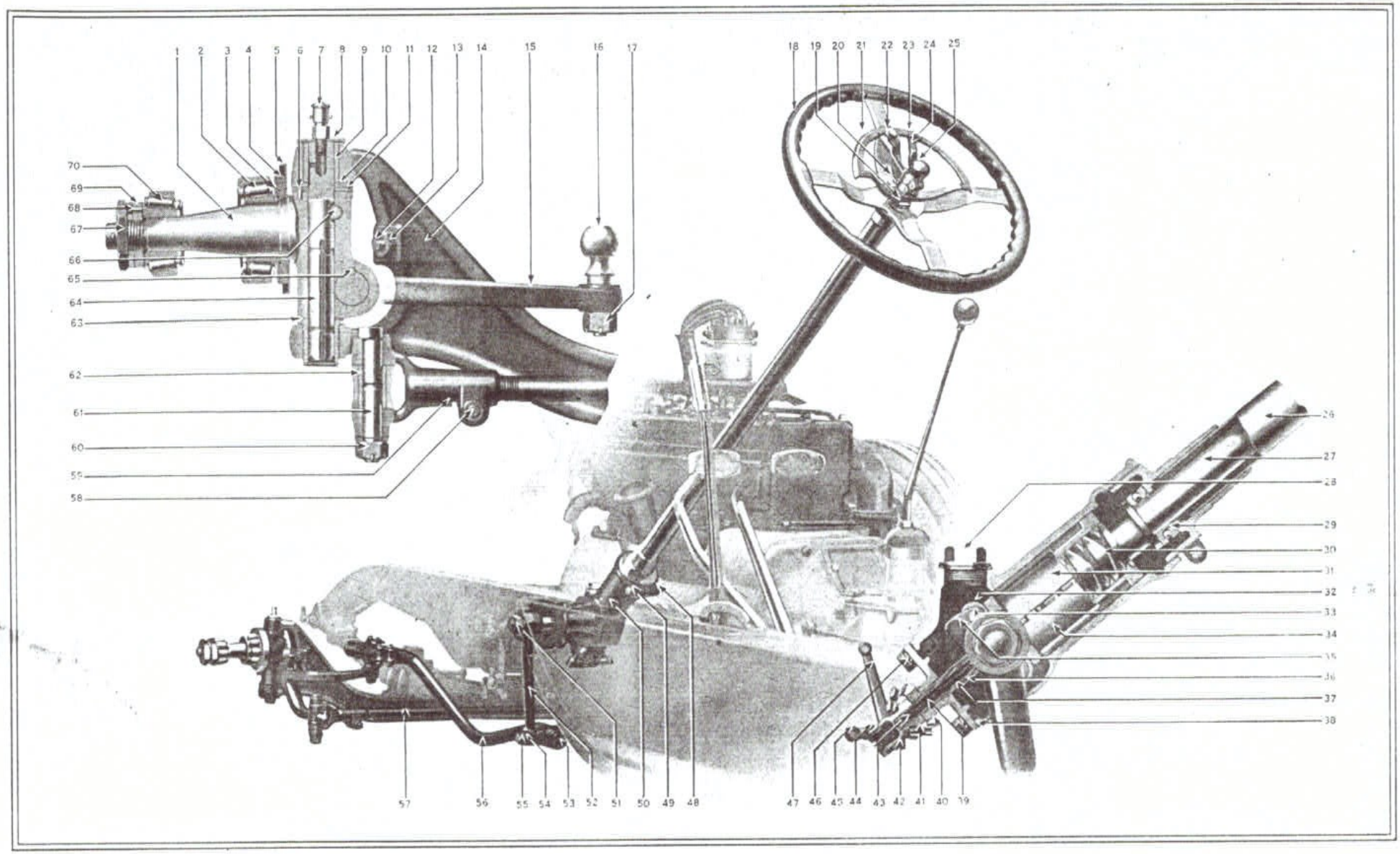


Plate No. 14—Steering and Front Axle

Running Gear Features

The frame consists of pressed steel channel section side members. All offsets are eliminated by tapering the frame from the front to the rear. Cross tubes are welded to rigid forgings and riveted to each end of the frame side members, in addition to regular cross members to prevent undue frame weave. Springs are all of the semi-elliptic type and are carried directly under the frame.

The front springs are 38 inches long by 2 inches wide. The rear springs are 54 inches long by 2¼ inches wide and are underslung from the rear axle.

A drop forged front axle is used. The rear axle is of the semi-floating type.

NOTE: It is advisable to inspect the spring clips on the axles periodically and tighten them firmly—this is good insurance against spring center breakage.

The Steering Gear

The steering gear is of the worm and split nut type.

Keep the steering mechanism properly lubricated and attention will be required only at long intervals.

Plate No. 14—Front Axle and Steering

Ref. No.	Name of Part
1.	Steering knuckle
2.	Steering knuckle inboard bearing
3.	Steering knuckle inboard bearing spacer
4.	Steering knuckle inboard bearing dust washer
5.	Steering knuckle inboard bearing dust washer retainer
6.	Steering knuckle thrust washer lower dowel
7.	Steering knuckle lubricator connector
8.	Steering knuckle pin dust shield
9.	Steering knuckle pin bushing—upper
10.	Steering knuckle thrust washer—upper
11.	Steering knuckle thrust washer—lower
12.	Steering knuckle stop screw
13.	Steering knuckle stop screw nut
14.	Front axle
15.	Steering knuckle lever left
16.	Steering knuckle lever ball joint
17.	Steering knuckle lever ball joint nut
18.	Steering wheel
19.	Steering post upper end nut
20.	Steering post spark and throttle sector screw
21.	Steering post spark and throttle sector
22.	Steering post spark control sector lever
23.	Steering post spark and throttle sector lever snub
24.	Steering post throttle sector lever
25.	Steering post horn button
26.	Steering pillar tube
27.	Steering worm and post assembly
28.	Steering gear case oil hole plug
29.	Steering worm thrust bearing
30.	Steering worm
31.	Steering worm nut upper half
32.	Steering yoke roller
33.	Steering yoke roller pin
34.	Steering worm nut lower half
35.	Steering yoke and rollers assembly
36.	Steering post spark and throttle sector anchor tube
37.	Steering post throttling shaft
38.	Steering gear housing end plate
39.	Steering post spark control shaft
40.	Steering post throttle gear—small
41.	Steering post spark control gear—small
42.	Steering post throttle lever screw
43.	Steering post horn button cable assembly
44.	Steering post spark control gear screw
45.	Steering post throttle lever
46.	Steering gear housing end plate cap screw
47.	Steering post spark control lever
48.	Steering gear case nut
49.	Steering gear case screw
50.	Steering gear case
51.	Steering yoke nut
52.	Steering lever
53.	Steering connecting rod plug
54.	Steering lever ball joint nut
55.	Steering lever ball joint
56.	Steering connecting rod
57.	Steering cross tube
58.	Steering cross tube yoke end clamp bolt
59.	Steering cross tube yoke end
60.	Steering cross tube yoke end pin nut
61.	Steering cross tube yoke end pin
62.	Steering knuckle lever bushing
63.	Steering knuckle pin bushing lower
64.	Steering knuckle pin
65.	Steering knuckle lever key
66.	Steering knuckle pin key
67.	Steering knuckle adjusting nut lock nut
68.	Steering knuckle adjusting nut pin
69.	Steering knuckle adjusting nut
70.	Steering knuckle outboard bearing.

The steering worm is provided with a ball thrust bearing and adjusting nut at the upper end of the gear housing. In order to take up any back lash or lost motion in the steering gear, loosen the clamp which holds the steering post to the instrument board. Adjust the large nut at the top of the steering gear housing so that the steering wheel has about 1 inch of lost motion at the rim.

Turn wheels from hard-over to hard-over by the hand wheel—to make certain that there is no binding—before driving the car after adjustment.

Steering Connections

Keep all exterior steering connections properly lubricated, frequently inspecting them to see that all bolts are tight.

Front Wheel Alignment

The front wheels should have a toe-in of $\frac{1}{8}$ to $\frac{3}{16}$ inch, that is, difference between measurements taken between the felloe bands at the front and rear of the wheels on a horizontal plane through the steering knuckle spindle.

To adjust, proceed as follows:

Remove the clevis pin at one end of the steering cross tube. Loosen the clevis locking bolt. Lengthen or shorten the cross tube as desired by turning the clevis. Lengthening the cross tube increases the toe-in.

Be sure to clamp all bolts securely. Revolve wheels one-half revolution and check adjustment at the same point on the felloe.

Steering Knuckle Stops

Adjust the steering knuckle stop screws in the front axle outer ends so that in hard-over positions the tires do not touch any part of the chassis or running gear and so that they stop the movement of the steering knuckle before the steering gear bottoms in its case.

Front Wheel Bearings

The front wheels are mounted on tapered roller bearings which fit into tapered races in the wheel hub core.

To adjust the front wheel bearings, tighten the adjusting nut as tight as possible with one hand, using a wrench having about a 12-inch handle, then back off nut one-half turn, locking it in this position with the pin that goes through the locking washer and adjusting nut; tighten the outside nut and insert cotter pin. Great care should be taken not to get the bearings too tight. The wheel should turn freely under pressure of one finger.

NOTE: The adjusting nut is the nut nearest the bearing.

Universal Joints

There are two universal joints on the driving shaft, between the transmission and rear axle.

These are surrounded by metal casings and are packed in grease. When necessary, additional grease may be added through one lubricator connector at each joint.

Foot and Hand Brakes

There is an external contracting brake and internal expanding brake on each wheel. The external or service brakes are operated by the right pedal. The internal or emergency brakes are operated by the hand lever.

Both external and internal brake bands are faced with a wire woven asbestos fabric which contacts with the rear wheel brake drums.

Keeping all working connections of both the foot and hand brakes properly oiled will materially assist in maintaining the effectiveness of the braking power.

Foot Brake Adjustment

Before adjusting the foot brake, make sure that the brake linkage is correct. After having once been properly set it will not need further attention.

To check the linkage, see that the stops on the equalizer levers just clear the rear of the center frame cross member when the pedal is back against the floor board. This adjustment may be made by changing the length of the front connecting rod as required, the connections to the rear of the equalizer being slacked off if necessary.

Next, see that the brake band operating lever for each wheel clears the front bracket by ¼ inch with the brakes released. This is necessary to secure proper braking pressure on each side. If the position of these levers is not correct they can be adjusted by changing the length of the rear connecting rod.

Periodic adjustment of the brakes will be necessary as the lining wears, and should be made as follows:

First, set the adjusting screw at the rear band support, so that the band has $\frac{1}{32}$ inch clearance at this point when the brake is released.

Tighten the large nuts on adjusting screws uniformly on each band, until the bands make complete contact with the drums when the center of the pedal pad bolt is 1½" from the incline toe board. When the brake is applied, the brake equalizer levers should still be an equal distance from the frame channel. If this is not the case it will be found that one band has been tightened more than the other, or that one of the bands is not making complete contact with the drum or is out of round.

Adjust the two nuts on the shank of the clevis at the front of the brake until the clearance is the same at the upper and lower sections of the band. If all adjustments have been made properly, the entire band will now have a clearance of $\frac{1}{32}$" to the drum.

Hand Brake Adjustment

The hand or internal brakes should be evenly adjusted so that when applied there is the same pressure of the lining on each rear wheel drum. The following adjustments are to be made:

By removing the rear wheel the hand brake band can be set concentric with the brake drum by means of an adjusting set screw at the rear.

The band should just clear the drum at this point.

Make all adjustments for wear on the side pull rods connected to the cam shaft levers, relocating the cam shaft levers for proper cam action as required.

The hand lever should be in the fourth notch from the front when brakes are applied.

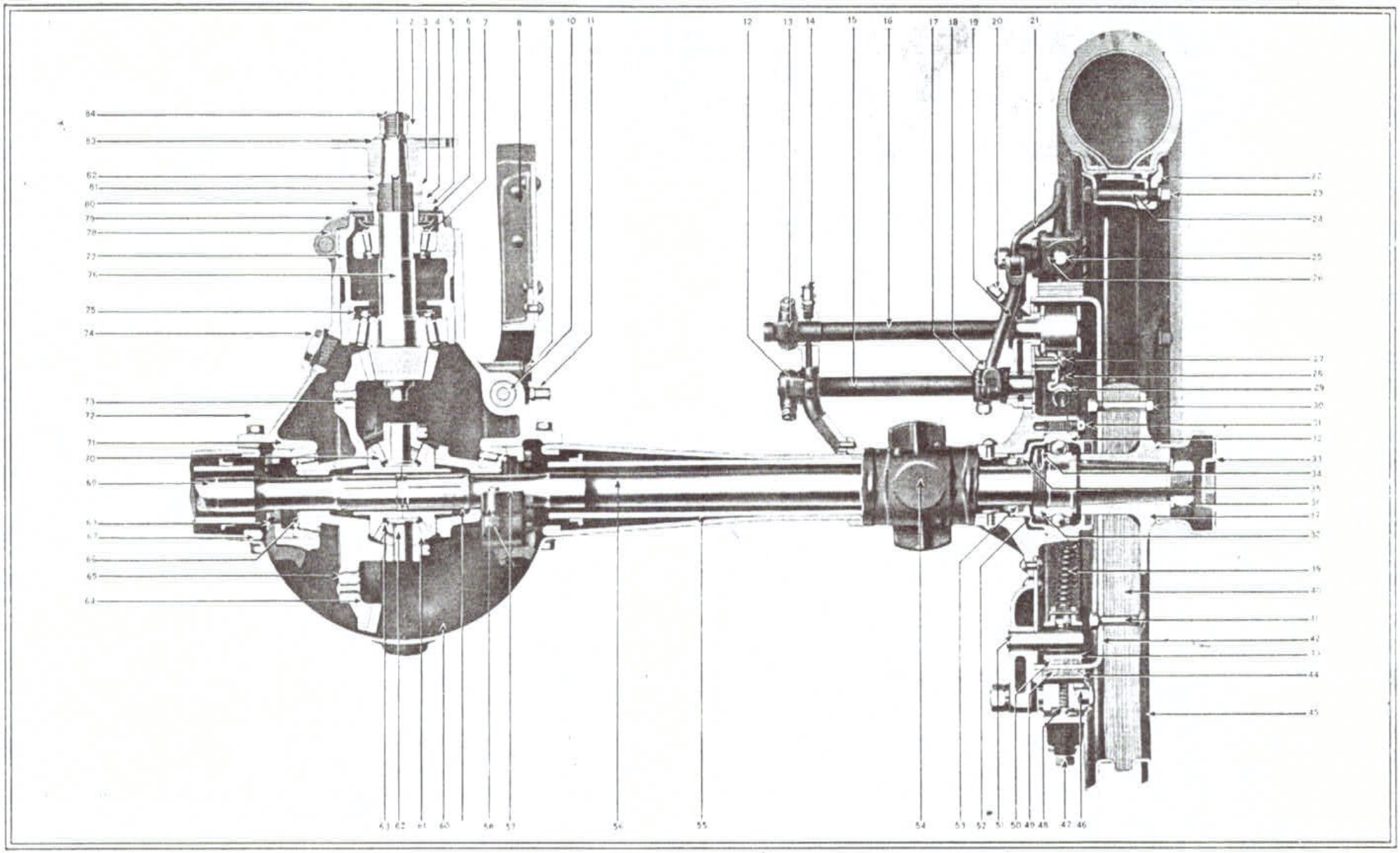


Plate No. 15—Rear Axle and Brakes Section

Use of Brakes

Apply the brakes gradually.

When stopping the car, or slowing it for rounding corners, reduce the speed as much as possible by closing the throttle and apply the brakes, disengaging the clutch before actually coming to a stop.

If the brakes are in good condition, and properly adjusted, either the foot or the hand brakes are sufficient to slide the wheels.

When decending very steep hills, assist the brakes by shifting the gears into second speed, engaging the clutch, closing the throttle and allowing the motor to run with the spark advanced. If it becomes necessary to use the brakes in descending a hill the foot and hand brakes should be applied alternately. When using the motor in second as a brake, keep speed below 30 miles an hour.

Plate No. 15—Rear Axle and Brakes Section

Ref. No.	Name of Part
1.	Differential driving pinion flange key
2.	Differential driving pinion flange washer
3.	Differential driving pinion bearing front jamb nut washer
4.	Differential driving pinion bearing front dust washer collar
5.	Differential driving pinion bearing dust washer retainer
6.	Differential driving pinion front bearing oil thrower
7.	Differential driving pinion bearing cone and rollers—front
8.	Rear axle torque arm
9.	Differential carrier torque arm pin clamp screw
10.	Differential carrier torque arm pin
11.	Lubricator connector
12.	Foot brake operating lever inboard—right
13.	Hand brake operating lever—right
14.	Lubricator connector
15.	Foot brake operating shaft and collar assembly
16.	Hand brake cam and collar assembly
17.	Foot brake operating lever outboard
18.	Foot brake operating lever (outboard) clamp bolt
19.	Foot brake operating lever connecting link
20.	Lubricator connector
21.	Foot brake band lever—right
22.	Wheel rim clamp
23.	Wheel felloe bolt nut
24.	Wheel felloe bolt
25.	Foot brake band adjusting rod
26.	Foot brake support bracket pin
27.	Hand brake expanding ring stop plate screw
28.	Hand brake expanding ring retracting spring—front
29.	Hand brake expanding ring stop plate
30.	Wheel hub flange to spoke bolt
31.	Rear axle shaft bearing retainer screw
32.	Rear axle shaft bearing
33.	Wheel hub cap
34.	Rear axle shaft bearing check nut set screw
35.	Rear axle shaft packing
36.	Rear axle shaft nut
37.	Wheel hub core—rear
38.	Rear axle shaft bearing check nut
39.	Hand brake expanding ring retracting spring—rear
40.	Wheel assembly—rear
41.	Wheel spoke to brake drum bolt
42.	Foot brake drum
43.	Hand brake expanding ring
44.	Foot brake band
45.	Wheel felloe
46.	Foot brake anchor pin
47.	Foot brake band anchor bracket pin adjusting screw
48.	Foot brake band anchor bracket spring
49.	Foot brake band lining
50.	Hand brake expanding ring facing
51.	Hand brake anchor pin
52.	Rear axle shaft packing retainer
53.	Rear axle shaft packing nut
54.	Rear axle shaft bearing sleeve—right
55.	Rear axle case assembly
56.	Rear axle shaft—right
57.	Differential carrier cap
58.	Differential carrier cap stud nut
59.	Differential case—plain half
60.	Rear axle case cover assembly
61.	Differential case bolt
62.	Differential pinion spider
63.	Differential pinion
64.	Differential driving gear
65.	Differential driving gear rivet
66.	Differential bearing cone and rollers
67.	Rear axle case cover screw
68.	Differential bearing adjusting nut lock
69.	Rear axle shaft—left
70.	Differential gear
71.	Differential bearing adjusting nut
72.	Rear axle case to differential carrier screw
73.	Differential case—flange half
74.	Differential carrier oil hole plug
75.	Differential driving pinion bearing cone and rollers—rear
76.	Differential driving pinion
77.	Differential driving pinion bearing sleeve
78.	Differential driving pinion bearing sleeve clamp bolt
79.	Differential driving pinion bearing sleeve lock
80.	Differential driving pinion frt. bearing dust washer retainer
81.	Differential driving pinion bearing frt. bearing adjusting nut
82.	Differential driving pinion frt. bearing jamb nut
83.	Differential driving pinion flange
84.	Differential driving pinion shaft nut

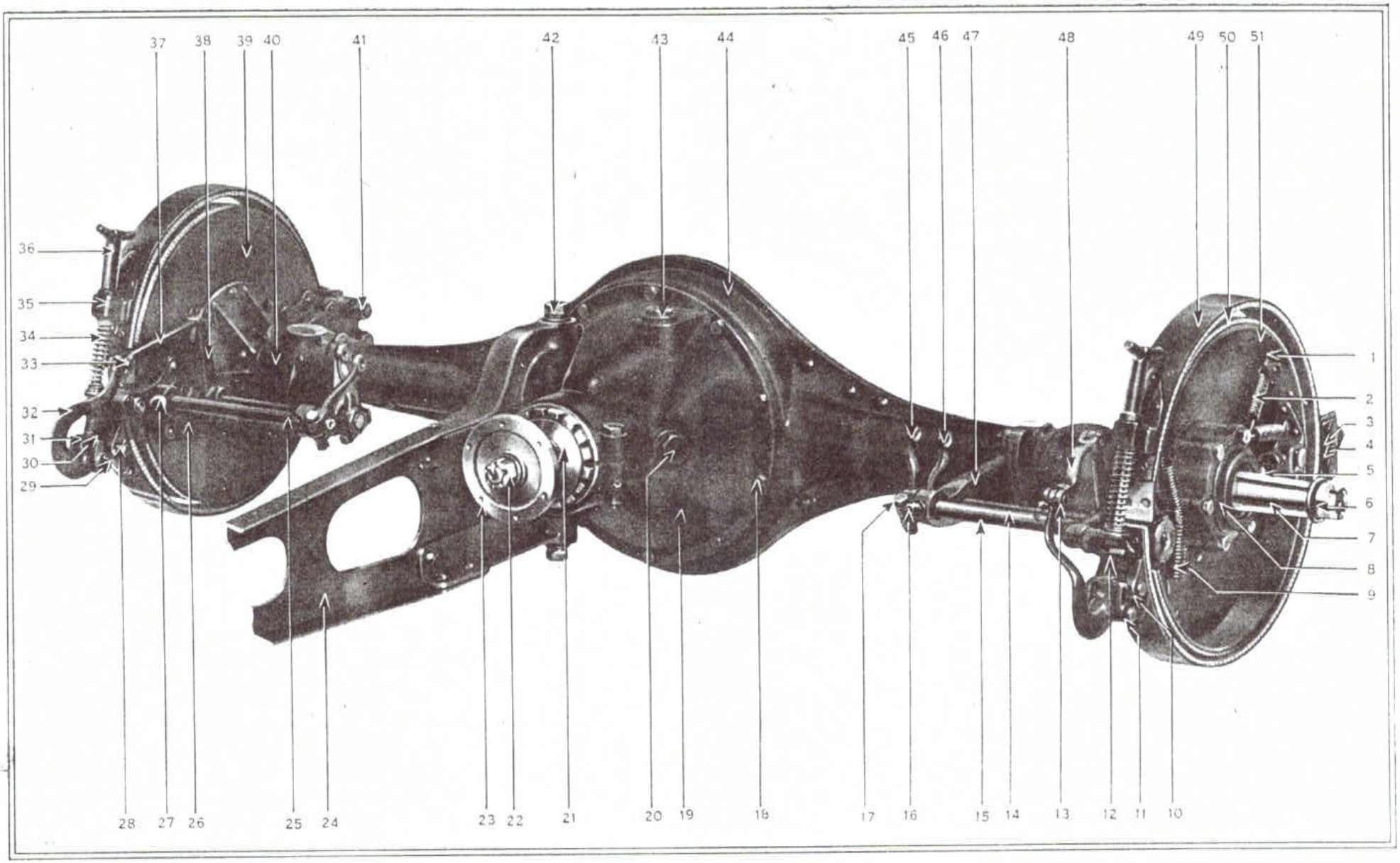


Plate No. 16—Rear Axle and Brake Construction

Rear Axle

The differential is mounted on tapered roller bearings supported in the differential carrier which is bolted to the front face of the rear axle case. The axle shafts are mounted on ball bearings at the outer ends of the case and are fitted to the differential gears at the inner ends by means of splines. The rear wheels are keyed directly to the axle shafts.

The differential bevel gears are adjusted at the factory and should require no further attention other than to receive proper lubrication. If for any reason the differential has been disassembled, re-adjustment of the gears should be made by the Service Department of a Packard Distributer.

Cold weather has the effect of thickening the rear axle lubricant, and it should be diluted with enough cylinder oil to bring it back to its summer consistency. A very thick oil in cold weather may become entirely non-fluid, so that it simply lines the walls of the case without lubricating the gears and bearings.

Cleaning Rear Axle

It is a good plan to drain the oil from the rear axle case after about every 10,000 miles and to flush out the case with kerosene. This can be done by removing the rear cover plate. After replacing the cover plate, refill to the level indicated by the filler plug in the cover.

Plate No. 16—Rear Axle and Brake Construction

Ref. No.	Name of Part
1.	Hand brake expanding ring assembly
2.	Hand brake expanding ring retracting spring—rear
3.	Foot brake anchor pin
4.	Foot brake anchor block
5.	Foot brake band anchor bracket pin adjusting screw
6.	Rear axle shaft nut
7.	Rear axle shaft—left
8.	Rear axle shaft bearing retainer
9.	Hand brake expanding ring retracting spring—front
10.	Foot brake band bracket—lower
11.	Foot brake band bracket lower pin
12.	Foot brake band adjusting rod stop nut
13.	Foot brake operating lever connecting link pin
14.	Foot brake operating shaft and collar assembly
15.	Hand brake cam and collar assembly
16.	Lubricator connector
17.	Foot brake operating lever inboard clamp bolt
18.	Differential carrier screw
19.	Differential carrier and caps assembly
20.	Differential carrier oil hole plug
21.	Differential driving pinion bearing sleeve
22.	Differential driving pinion shaft nut
23.	Differential pinion flange
24.	Rear axle torque arm assembly
25.	Lubricator connector
26.	Rear axle brake anchor
27.	Lubricator connector
28.	Foot brake band bracket lower pin
29.	Foot brake band adjusting rod yoke end pin
30.	Foot brake band adjusting rod
31.	Foot brake band adjusting rod
32.	Foot brake band lever—right
33.	Foot brake operating lever connecting link pin
34.	Foot brake band adjusting rod spring
35.	Foot brake band bracket—upper
36.	Foot brake band adjusting nut
37.	Foot brake operating lever connecting link
38.	Foot brake operating lever—outboard
39.	Rear axle support plate
40.	Rear axle shaft bearing sleeve—right
41.	Foot brake anchor pin nut
42.	Rear axle torque arm rear end retaining screw
43.	Differential carrier oil hole plug
44.	Rear axle case
45.	Foot brake operating lever inboard—right
46.	Hand brake operating lever—right
47.	Rear axle brake operating shaft inboard—left
48.	Foot brake operating lever connecting link
49.	Foot brake band
50.	Foot brake band lining
51.	Hand brake band lining

Oil Leakage

Too high an oil level in the rear axle case is the most common cause of leakage, so the level should always be checked and the consistency of the oil inspected before other steps are taken on a leaking axle.

Oil leakage at the driving pinion aside from being due to high level, indicates improper functioning of the oil throw off and return mechanism which takes the oil working along the pinion shaft and returns it to the axle case. An inspection of this mechanism should deal principally with the fits of the parts in the axle case forward extension and on the pinion shaft. Light drive fits are required. Oil return holes should be cleaned if clogged by thick oil, etc.

Oil leakage at the axle shaft outer end, with proper oil level in the case, indicates improper stuffing box action and the shaft should be removed and the stuffing box, which comes out with it, repacked or tightened as required.

Rear Axle Shaft Outer Bearings

Whenever the wheels are removed, the axle shafts should also be removed and the ball bearings on the shaft outer ends repacked with grease. It will be noted that the construction traps the grease around these bearings so that it is not required to pull the axle shafts specifically for the purpose of lubricating the bearings. The lubricant once applied can be expected to last almost indefinitely.

Rear Axle Connections

It is advisable to tighten the torque arm rear end anchorage and other bolts and nuts on the rear axle periodically as in this way a number of annoying rattles may be prevented as well as actual depreciation of the parts involved.

Rear Axle Noise

If an unusual noise is noticed in the rear axle it is advisable to consult a Packard service station at once. It can then be ascertained whether or not damage has occurred or is apt to occur. The object of an early consultation is to prevent damage to expensive parts due to possible failure of parts or lack of adjustment of other parts.

Equalizing Wheel Traction

Tires of the same diameter should always be used on the rear wheels. Tire chains and special treads should always be used in pairs.

Any variation in the diameter of the rear tires or in the traction of the wheels causes the differential to work whenever the car is in motion. The result is considerable waste of power and unnecessary wear of the differential parts. In addition the smaller diameter or smoother tire-to-road contact will suffer from braking friction as it will slide more easily than the other.

Spring Clips

Keep the spring clips tight.

Spring breakage is frequently due to the spring clips being loose and not holding the spring firmly to its seat. The spring clips will require taking up more frequently when new than after the vehicle has been in service for a few hundred miles.

General Index

Illustrations

Operation and Care

License Data

Number of Cylinders	6
Cylinder bore	$3^{3}/_{8}$ in.
Horsepower (N. A. C. C. rating)	27.31
Piston Displacement	268.1 cu. in.
Stroke	5 in.

Shipping Weights

	1-26	1-33
Touring	3144 lbs.	3240 lbs.
Roadster	2956 lbs.	
Coupe	3230 lbs.	
Sedan	3355 lbs.	3535 lbs.
Sport	3080 lbs.	
Semi-Limousine		3585 lbs.

Size of Tires	33 x 4½ in.
Road Clearance	10 in.
Wheel base	126 - 133 in.

Vehicle No. _____

On Manufacturer's patent plate

Motor No. _____

On right front crank case upper half